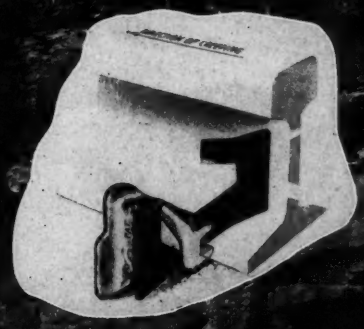
MAY, 1923

Railway Engineering and Maintenance

VAUGHAN

RAIL ANCHORS

hold expansion allowed when rail is laid



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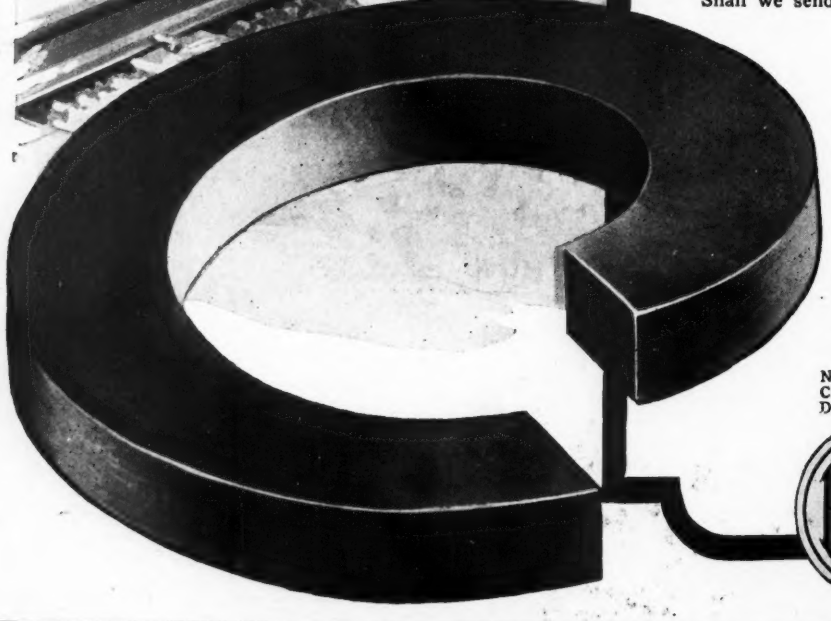
RELIANCE HY-CROME NUT LOCKS

Save Track Labor

EVERY low joint, every stripped bolt or broken splice plate, necessitates immediate attention, and if such occurrences are unduly frequent in any section, the labor cost for track maintenance in that section is bound to be high.

We are firmly of the opinion, in view of the consistent service performance of our product, that Reliance Hy-Crome Nut Locks will appreciably reduce the cost of track maintenance as affected by rail joints.

Shall we send you samples to test?



The Reliance Manufacturing Co.
MASSILLON, OHIO

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RAILWAY ENGINEERING AND MAINTENANCE
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Alphabetical Index to Advertisements Page 34
Classified Index to Advertisers, Pages 32 and 34

The Mudge "ALL-SERVICE" Motor Car

CLASS "WS-1"

Maximum Utility

Easy Accessibility

A Universal Car for Section, Bridge and Extra Gang Duty

Equipped with the new ***Mudge water-cooled, roller-bearing engine,*** rated at 8 horse-power, which actually develops 25 per cent above its rating.

The tilting top makes all parts easily accessible. It is independent of the controls or wiring, and carries the seat and safety railings only. It is provided with stout hinges and an upright for supporting it when raised. It locks securely in position when lowered, forming an integral part of the car.

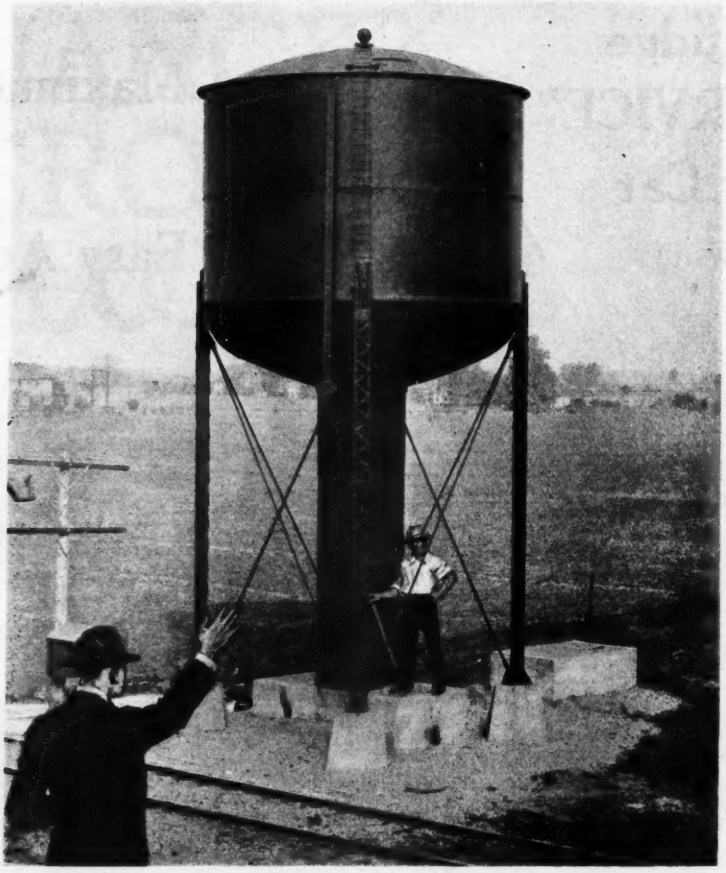
The "All-Service" car weighs less than 1,000 pounds and is properly balanced for a one-man lift.

Seats 10 men—pulls 10,000 pounds.

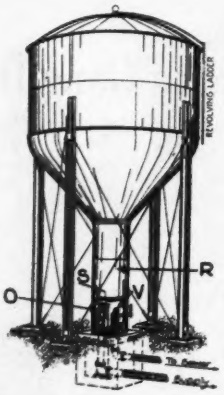
"The One Car for All Jobs"

Mudge & Company

Manufacturers—Railroad Equipment
Railway Exchange Bldg. · CHICAGO



"That's Right, Jack, Keep Her Cleaned Out"



Self-Cleaning is a Feature of Horton Tanks

The conical-bottom prevents sediment from settling on tank bottom.

Sediment settles into large riser, R.

Outlet pipe, O, extends above bottom of large riser—

Providing a settling basin, S, into which mud settles, leaving only *clean water* above mouth of outlet pipe.

By simply opening the Horton washout valve, V, the accumulated mud is flushed out.

"It's so easy to clean a Horton *steel* tank," continued the Supervisor, "that there's no excuse for not keeping the mud flushed out. Just open the washout valve ever so often and hold her 'till she runs clear.

"It's a good thing you don't have a flat-bottom tank on your section, Jack, else you'd be climbing in with a shovel and cleaning your tank with elbow grease.

"With a Horton *steel* tank you are not only saved the labor of cleaning, but you're giving the mechanical department *clean water* and helping them avoid boiler trouble.

"Believe me, I'll be glad when my requisitions go through for the steel tanks which will make my subdivision *steel throughout*. That will be the end of tank troubles for yours truly."

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192

Single Track Signaling on C. & N. W.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 19 May, 1923 Number 5

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WOULD YOU LIKE TO KNOW

Why switch point heel bolts should be inserted from the outside of the stock rail?

How motor trucks can save work train service?

How railroads can save water?

A practical use of old bridge ties?

How to select a camp site in malaria country?

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Request for change of address should reach us two weeks before the date of the issue with which it is to go into effect. It is difficult and often impossible to supply back numbers to replace those undelivered through failure to send advance notice. In sending us change of address please be sure to send us your old address as well as the new one.

Subscription price in the United States, Canada and Mexico $2.00 per year; foreign countries $3.00. Single copies, 35 cents. Foreign subscriptions may be paid through our London office (34, Victoria Street, S. W. 1) in £-s-d.

WE GUARANTEE, that of this issue 8,650 copies were printed; that of these 8,650 copies, 7,938 were mailed to regular paid subscribers, 11 were provided for counter and news company sales, 68 were mailed to advertisers, 225 were mailed to employees and correspondents, and 408 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 44,050, an average of 8,810 copies a month.

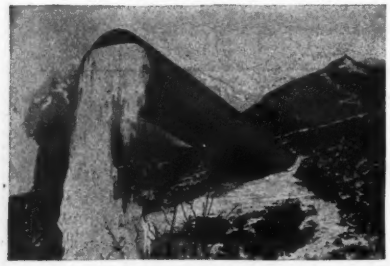
Railway Engineering and Maintenance is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulation (A. B. C.)

Only Corrugated Culverts Satisfy *Every* Small Culvert Requirement

STRONG: Close under the track with its pounding traffic, or buried down in the deepest fill, Armco Culverts always have a generous margin of safety. It is impossible to question their strength, for they have been proved UNCRUSHABLE when under a fill equal to their own diameter.

Elastic: Vibration and impact cannot break them. They give under weight of shifting earth, and then resume their shape. Freezing and thawing that tests the strongest monolithic construction—even a raging flood with a complete washout does no harm to Armco Culverts.

Economical: The cost installed, divided by years of service—that's the true cost of culvert construction. Light, compact, easily transported and quickly installed by unskilled labor without interruption to traffic—these factors make Armco Culverts the most economical of all for smaller transverse drainage projects of every sort.



Still in place after surrounding earth is dislodged.

Durable: They endure. On railway and highway they have been given the Test of Time. All over the United States and Canada, on great transcontinental railroads and famous highways, culverts of pure rust-resisting Armco Ingot Iron have been in use for more than a decade with hardly a sign of deterioration.

There is a manufacturer in nearly every state and in Canada, making Culverts and other products of genuine, rust-resisting Armco Ingot Iron. Write for full information and nearest shipping point on products in which you are interested.

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ARMCO CULVERTS

Ingot Iron

The Replacement of Broken Handles Is Less Than ONE in ONE THOUSAND

It would be folly to fit ordinary handles to Wood's Mo-lyb-den-um Steel Shovel Blades. Only the very pick of selected second growth northern white ash handles are good enough for these super shovels. Here is the way they are chosen:

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The exceptional wearing qualities of these handles are proven by actual use. Out of 60,000 shovels in use from six months to one year, less than 60 handles have been replaced. One railroad reported no broken handles after 300 shovels had been used for six months.

The wonderful wearing qualities of H. K. Wood's Molybdenum shovels recommend them for all uses. Send for our special folder showing their application to all railroad needs. Write today.

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Piqua, Ohio U. S. A.

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The American Super Steel

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ECONOMY

The remarkable progress of the oxy-acetylene industry is widely attributable to the consistent development of the Airco-Davis-Bournonville Torch and the service back of it.

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Manufacturer of Airco Oxygen — Airco Acetylene — Airco-Davis-Bournonville Welding and Cutting Apparatus and Supplies, Acetylene Generators, and Specially Designed Machines for Automatic Welding and Cutting— Nitrogen, Argon and other Airco Atmospheric Gas Products

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"Airco Oxygen and Acetylene Service is Good Service."

Section Car—M2, with Trailer

Performance on the Job Counts

Efficiency

An invariable characteristic of the performance of Fairmont Motors and Motor Cars is their amazing efficiency. Even under the most adverse conditions their ability to serve dependably is unaffected.

After long years of rough and hardy service they continue to respond to the limit of their original capacity. Veteran Fairmonts usually outpull and outwork other cars of somewhat higher rating.

Sturdily built of carefully chosen materials and designed by experienced railroad engineers, Fairmont Motors and Motor Cars are intended for extraordinary service. On whatever duty motor cars are required, Fairmonts will do a better job at a minimum cost.

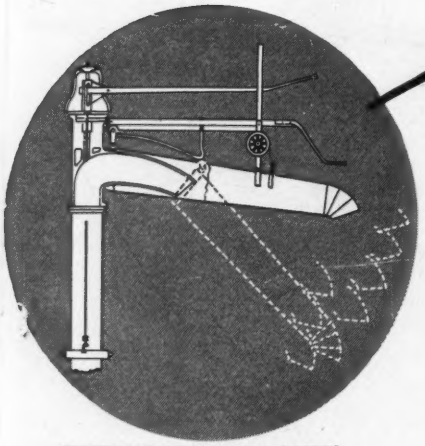
If in doubt ask the men on the line. Those who have used Fairmonts will substantiate these claims. Over 25,000 Fairmonts are working today.

FAIRMONT RAILWAY MOTORS, INC., FAIRMONT, MINNESOTA

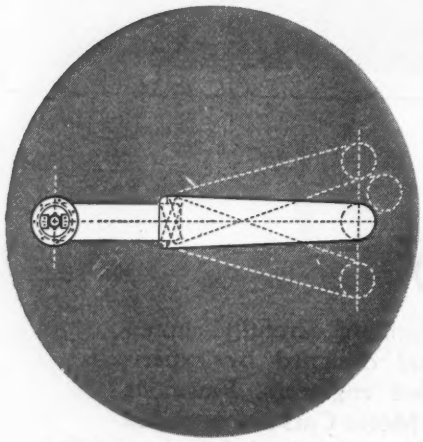
Descriptive Bulletins of Entire Line Supplied at Your Request

Fairmont

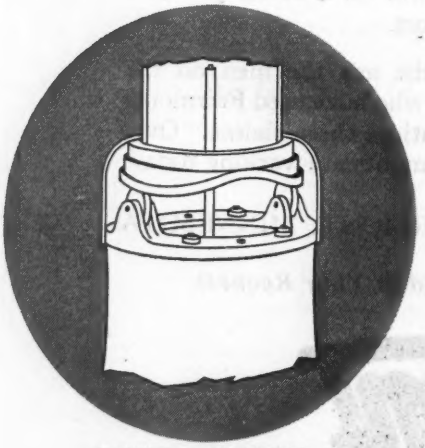
Ball Bearing Motors and Railway Motor Cars



SHOWING VERTICAL RANGE
FENNER DROP SPOUT



SHOWING LATERAL RANGE
FENNER DROP SPOUT



GRAVITY TURNING &
LOCKING DEVICE

Its Quicker-Easier-Safer

to fill your tender tanks with

POAGE *Style* "H" WATER COLUMN

Equipped with

Fenner Drop Spout

Quicker and Easier because the spout can be instantly brought into play without accurately spotting the tender. It works equally well with tenders of different heights. The spout has a vertical range of five feet and a lateral range of three.

The spout is non-freezable. Heavy icicles will not gather upon it. There is no packing at the open telescopic joint, yet, it does not leak a drop of water.

Safer—as soon as it is released the spout swings by gravity to a position parallel with the track and remains there locked. There are no unsafe locking devices to be operated.

The three foot lateral range of the spout prevents the column being tipped over if the tender shifts unexpectedly.

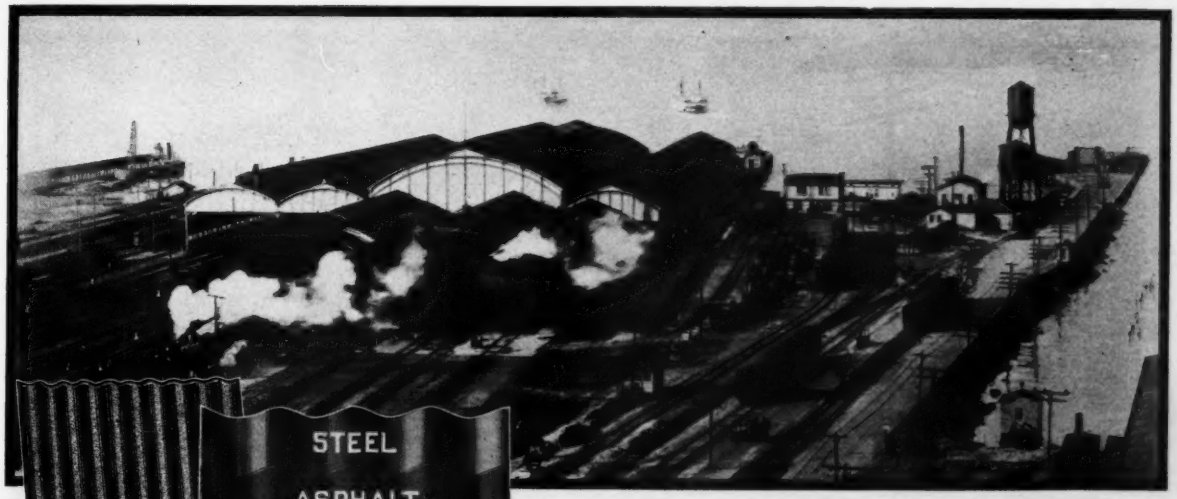
There is no danger of water hammer bursting the mains. The Poage Style H valve shuts off 85 per cent of the flow very quickly and the remaining 15 per cent more slowly—the correct principle to secure quick closure without water hammer.

Try the Poage Style H Water Column—It's better.

MANUFACTURED EXCLUSIVELY BY

The AMERICAN VALVE & METER COMPANY

CINCINNATI, O.



The upper illustration shows the pier of the Southern Pacific Railway at Oakland, California. APM used here as a roofing material is effectively resisting the destructive combination of sulphur dioxide fumes and and excessive humidity always prevalent in train sheds.

The accompanying illustration showing a "cut-away" view of APM Sheeting indicates how one impervious coating follows another in the process of protecting the metal core from all destructive influences.

A Sheet Metal Roofing *Plus* a Built-Up Roofing

Combining the Advantages of Both Having the Disadvantages of Neither

Robertson Process Asbestos Protected Metal (APM) is one of the few roofing and siding materials that will stand the severe conditions railway buildings encounter. With its triple-protective coating of (1) Asphalt, (2) Asbestos felt and (3) Waterproofing, APM is practically a corrugated steel roofing sheet to which a high-grade built-up roofing has been applied on both sides at the factory, instead of in the field.

APM has all the ***strength, adaptability and light-weight advantages*** of ordinary metal sheets without the greatest drawback of unprotected metal—its inability to resist rust and corrosion. And APM has all the durability of a built-up roof; but, unlike a built-up roof, it requires no supporting roof-deck. It is a roof and a roof-deck all in one. It completely resists the destructive action of smoke, steam, fumes, gases—all corrosive influences. It requires neither painting nor repairs.

Repeat Orders—The Proof of Value

	First Order	
American Car & Foundry Company	1913	10 orders
American Locomotive Company	1913	19 orders
Baltimore & Ohio	1909	5 orders
Chicago & Alton	1919	4 orders
Chicago, Burlington & Quincy	1920	16 orders
Chicago & Northwestern	1903	11 orders
Delaware, Lackawanna & Western	1921	2 orders
Erie	1917	7 orders
Missouri Pacific	1911	3 orders
New York Central Lines	1913	14 orders
New York, New Haven & Hartford	1915	14 orders
Norfok & Western	1913	3 orders
Pennsylvania System	1909	94 orders
Southern	1915	11 orders
Southern Pacific	1922	2 orders
Tela Railroad Company, Honduras	1920	6 orders
Truxillo Railroad Company, Honduras	1920	6 orders
Union Pacific	1909	40 orders

H. H. ROBERTSON COMPANY, Pittsburgh, Pa.

Factories: Ambridge, Pa., Ellesmere Port, Cheshire, England, Sarnia, Ont.
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APM

Tight Crossovers Save Rolling Stock

The sharp click-click of a tight Crossover is saving productive hours for cars and locomotives.

Selflock Nuts put the 50M to 60M pounds of reactive strength in the H. T. bolt to work holding the joints tight and they are locked in position to keep them tight.

The above Crossover was held tight 14 months under heavy freight service, with Selflock Crossing Bolts.

All standard types of bolts furnished with Selflock Nuts.

Selflock Nut and Bolt Co., Inc.

East Syracuse, N. Y.

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important aids to successful blasting

121 years of manufacturing and field experience has enabled the du Pont Company to produce a complete line of blasting accessories of the same unvarying high quality as du Pont explosives. To insure the best results be sure that the du Pont label is on *all* your blasting equipment—on your accessories as well as on the explosives themselves.

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Write for Blasting Accessories Catalog containing descriptions of above accessories and practical information about their use.

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Bethlehem Model 1222 Switch Stands

In addition to being low (only 4¼ inches from tie to bottom of lamp tip), and therefore recommended for use in close quarters, Bethlehem Model 1222 Switch Stand is built up of but four pieces, making for simplicity and strength.

The stand here illustrated was installed June 24, 1920, and has since then been thrown about once every 2 minutes for 24 hours a day, 7 days a week. It has been run through several times without other damage than bending the connecting rod at the goose-neck.

This stand is used with all weights of rails. For light rail, specify Model 1217—adopted by United States Government.

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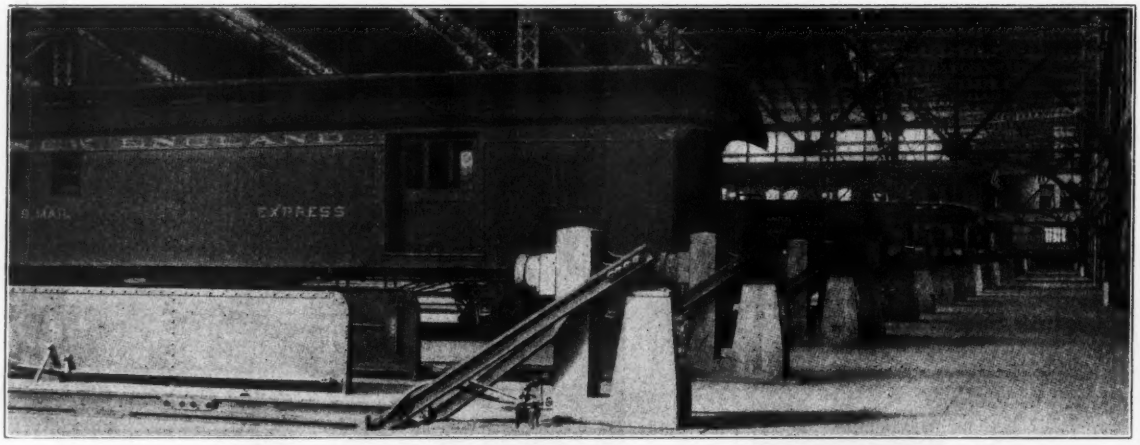

"THE PROOF OF THE PUDDING", Etc.

Installations of the kind shown above are made strictly on the merits of the

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"ELLIS" COMBINATION WOOD AND METAL POSTS
"DURABLE" ALL METAL BUMPING POSTS

Send us your orders—shipment from stock.

THE MECHANICAL MANUFACTURING CO.

Pershing Road and Loomis Street, CHICAGO, ILL.

THE METAL PROTECTIVE PAINT THAT GOES FARTHER

THE EAGLE-PICHER LEAD COMPANY — EAGLE — PICHER — ESTABLISHED 1840

Picher
SUBLIMED BLUE LEAD
What it is—What it does.

PICHER SUBLIMED BLUE LEAD is a "fume product"—made by subliming the lead ore, galena (lead sulphide) and collecting the fumes. The pigment thus produced is a slate gray powder, of impalpable fineness, which when mixed with pure linseed oil produces a paint of remarkable hiding power and exceptional brushing and spreading qualities, which will endure years of exposure in service, without cracking, checking or peeling. This pigment remains perfectly suspended in oil and will not harden in the container.

Low in first cost and of the highest efficiency in service, PICHER SUBLIMED BLUE LEAD will be found the best paint to use for all rust-proofing purposes.

EVEN IF PICHER SUBLIMED BLUE LEAD did not have unusual hiding power its superior rust-resisting qualities alone would justify its use for all metal protective paint jobs.

But it *does* have unusual hiding power.

The hiding power of a paint chiefly depends on the *fineness* of the pigment particles.

And the *subliming* process from which PICHER SUBLIMED BLUE LEAD derives its name imparts to this pigment a fineness impossible to obtain by any other method.

That is why pigments produced by other processes cannot have a hiding power equal to PICHER SUBLIMED BLUE LEAD.

So of course PICHER SUBLIMED BLUE LEAD *goes farther.*

In fact, one gallon of paint made of PICHER SUBLIMED BLUE LEAD and oil, in proportions 70/30 by weight, will cover from 600 to 800 square feet of structural steel.

That's paint economy.

And besides—PICHER SUBLIMED BLUE LEAD spreads easier and lasts longer. That's more paint economy.

And labor economy, too—its easy brushing qualities mean faster work.

Lack of space prevents us from telling in this advertisement all the advantages of PICHER SUBLIMED BLUE LEAD, but you can learn all about it in our booklet "Buying Rust Protection". We shall gladly send a copy at your request.

The EAGLE-PICHER LEAD COMPANY

208 SOUTH LA SALLE STREET, CHICAGO

Cincinnati · New York · Philadelphia · Detroit · Pittsburgh · Cleveland · Joplin · St. Louis · Kansas City · Baltimore · Buffalo · Minneapolis · New Orleans

Picher Sublimed Blue Lead *in Oil*

90% of PURE blue lead ground in 10% of PURE raw linseed oil

0220-11

Make Your Dump Car Requisition Read "Western"

Western —That's Why

Ditching with Western Air Dump Cars on the Wheeling & Lake Erie Railroad

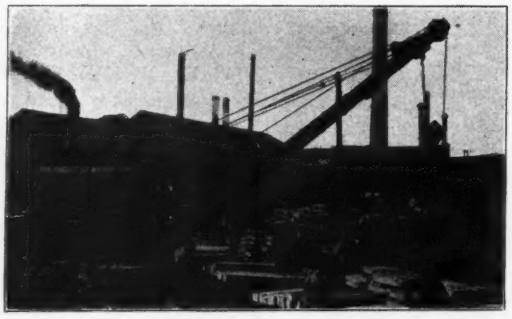
Most railroads are getting away from the cumbersome and vexatious cableplow methods of unloading cars in ditching and are adopting Western air dump cars. They will do twice the work with half the men, and with much less cost of maintenance and money invested.

Send for our illustrated Bulletin M-22J, describing our Extension Floor and Apron which can be put on new or old Western air dump cars and will dump the load clear of the ballast.

WESTERN WHEELED SCRAPER COMPANY

Earth and Stone Handling Machinery

AURORA, ILLINOIS



OSGOOD Ditcher as a Crane

A Machine of Many Uses

OSGOOD RAILROAD DITCHERS may be called Universal Machines. They can be used as a ditcher for ditching right of way or widening shoulder, as a Crane, as a Clamshell, or a Dragline. They can readily be mounted on Continuous Treads or Traction Wheels and moved about freely without, in any way, impairing the efficiency of the machine. Investigate the OSGOOD today.

Get our new Ditcher Bulletin

The OSGOOD Company

Marion, Ohio, U. S. A.

Water Purification Will Reduce Your Dead Motive Power

The experience of one road (operating about 75 per cent on purified water) was an increase of more than 50 per cent in continuous locomotive mileage and the freeing of sufficient motive power to permit remodeling an obsolete type of engine at the rate of seven in one year as compared with a former rate of two per year.

More locomotives in operation, more rebuilt locomotives added to service and accomplished *with a reduction in number of shopmen.*

A W S EQUIPMENT IS USED BY MANY OF THE LARGEST RAILWAYS

AMERICAN WATER SOFTENER COMPANY

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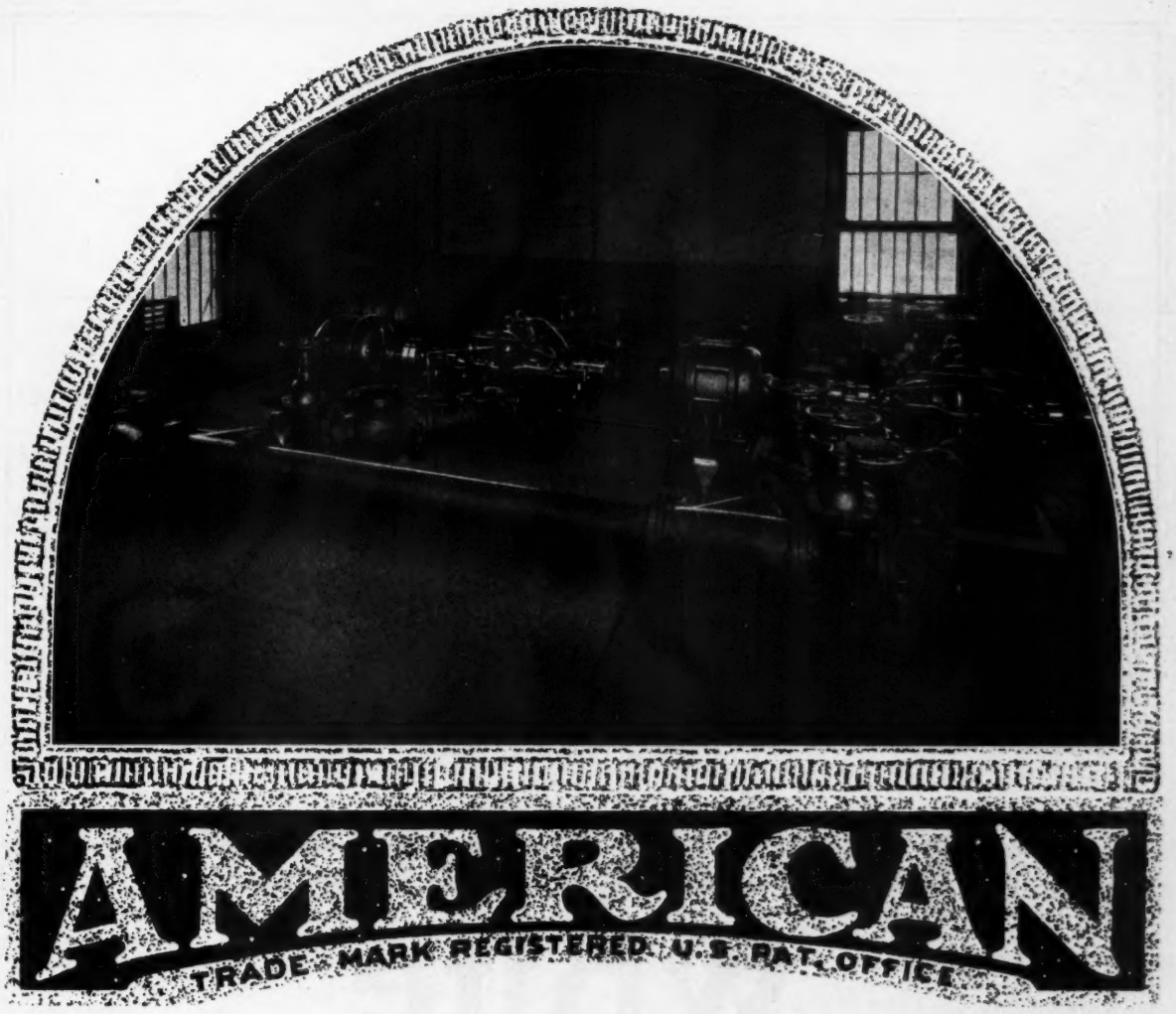

"American" Pumps in a Typical Railway Pumping Station

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The water for the three locomotive supply tanks which this station supplies is pumped from the Kankakee River by two 5-inch American Centrifugals direct connected to 25 HP., 1800 R.P.M., G. E. Motors, automatically regulated by the Sundh control panel.

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Railway
Engineering and Maintenance

Volume 19 May, 1923 No. 5

THE RAILWAY'S INTEREST IN THE CREOSOTE SHORTAGE

THE wood preserving industry has been developed largely around creosote as the preservative. It is employed exclusively for marine work and largely for timber intended for other uses. More than half of all of the timber treated normally receives this preservative. When therefore the supply of creosote is threatened and the price rises to a high figure the stability of the industry and the interests of the large users of treated wood are jeopardized. This is the situation at the present time.

Approximately half of the creosote normally used in this country comes from Europe, principally from Germany and England. The disturbed industrial conditions in the former and the large highway program in the latter have greatly reduced the exportations from those countries. American producers have never attempted to meet domestic requirements in full so that the reduction in importation creates a shortage.

This problem is of vital interest to the railways for they consume more than 90 per cent of all of the timber treated. It is particularly important for the engineering and maintenance of way department, as practically all of the timber treated for the railways is used under its direction. For this reason engineering officers should give this situation careful consideration and should aid the specialists in timber preservation in developing means of overcoming the effects of this shortage.

Zinc chloride is used in large quantities, particularly for the treatment of ties and its more extended application is worthy of careful consideration. The Central Railroad of New Jersey and the Philadelphia & Reading, has recently started the use of a mixture of creosote and crude oil in the proportions of 30 per cent creosote and 70 per cent fuel oil. These and other expedients should be studied carefully at the present time in order that established programs for the protection of timber against decay may not be curtailed and that the amount of creosote available may be made to render the maximum service.

THE PROBLEM OF THE BURNED TRESTLE

AMONG the train accidents reported briefly elsewhere in this issue, the one resulting from the burning out of a three-span pile trestle can well be given serious thought by the maintenance of way officer because it was brought about through a series of circumstances which could readily be duplicated on almost any other line of similar character on the American continent. The bridge was of wood. It had a sheet metal fire protection but this was incomplete by reason of a four-inch longitudinal gap inserted to provide insulation for a track circuit for a crossing bell. The fire which destroyed the bridge occurred late on a Sunday afternoon and the line was one of such light traffic that in accordance with normal usage in this country, it was not patrolled outside of the regular working hours of the track forces and the accident occurred early in the morning before the section gang had an opportunity to visit the site of the bridge.

This accident points to one of those intangible benefits of the ballasted deck timber trestle or the reinforced concrete trestle which ordinarily cannot be represented in dollars and cents in comparative cost estimates. It also demonstrates that a sheet metal protection is not a protection unless it covers the deck of the structure completely, and furthermore, that any breaks or opening in the sheathing, whether introduced deliberately as in this case or present as the result of poor maintenance, will largely destroy the value of such a protection.

AN OPPORTUNITY FOR THE RESTORATION OF AN EQUITABLE WAGE SCALE

THE WAGES of maintenance of way employees are again on the upward trend. A number of roads have announced increases in their rates of pay during the past month and others are considering the same action. This step is being taken by the roads on their own initiative, without suggestion or order of any kind from the Labor Board.

One of the serious injustices of the present wage scale is the uniform rate first established by the Railroad Administration during the period of government control and since perpetuated by the Labor Board. This basis fails to recognize the value of experience and the varying living conditions in local communities which influence the income of the employee, measured in purchasing power. By advancing the wages of their employees by individual action according to a program developed in most instances by conferences with representatives of their own employees, familiar with these local conditions, an opportunity is offered to remove the inequalities. This has been done in most instances in which readjustments in wages have already been announced.

The requirement that a railway shall pay a uniform rate to all employees performing similar work without reference to the cost of living and other local conditions has discriminated against the employees living in the larger communities. In the revision of their rates of pay a number of the roads have given greater increases to the employees in these localities than elsewhere. Also many maintenance officers have long contended that rates of pay should be graduated according to experience. This has been impossible in large measure with the uniform wage. It is, therefore, interesting to note that the Boston & Maine, in readjusting its wage rates, has established a differential in favor of those of its employees of more than six months' experience.

Marked progress is being made in the return of the roads and their employees to mutual negotiations and agreements regarding wages and working conditions. It is to be hoped that the increases which are now being given employees of this department of railway service and the manner in which these increases are being distributed will hasten the return of this method of negotiation universally.

WHAT KIND OF TIES ARE YOU GETTING?

OF EVERY dollar spent for maintenance of way more than 12 cents goes for ties. If the cost of handling and inserting them in the track is added nearly one-fifth of all of the money spent by the maintenance of way department goes for this purpose. Ties have no salvage value, so that their first cost is their net cost. It is, therefore, self-evident that the quality of ties used should receive the most careful consideration.

Yet what do we find today? Because of the excessive demand, the tie market is in a most chaotic condition. Prices have risen greatly and, even more serious, inspection has been lessened to the point that the quality has been greatly lowered. While this is not being reflected in most cases in the character of the ties now being distributed for renewals owing to the interval which is required for seasoning and in most cases for treatment, it is nevertheless a most serious condition which will be evident in pronounced form when the ties now being purchased are ready for use. While the buying and in most cases the inspection of ties is handled by the purchasing department, the responsibility for this condition is not confined to that department, but must be shared by maintenance of way officers, for it is under their direction that the ties are used and it is to their accounts that expenditures for this purpose are charged.

It is the function of the purchasing department to purchase ties in the quantity and of the quality desired by the maintenance of way department, and it is the duty of the maintenance officers to demonstrate to their managements the economy of uniform purchases from year to year, thereby avoiding the wide fluctuations in demand which have tended to produce the present conditions. It is the further responsibility of maintenance of way officers to insist that the purchasing department secure for them ties of proper quality and to take such measures as may be necessary to insure that their requirements are complied with.

Maintenance of way officers have not given this subject the attention which it deserves. The contention that the concentration of responsibility in the purchasing department for the quality of ties bought is of such long standing that no change can be expected has little weight when one considers that the same argument was advanced when it was proposed a few years ago to change the end of the fiscal year from June 30 to December 31. When maintenance officers were convinced that this change was desirable to the point that they were willing to agitate the subject among their managements, the change came about so rapidly as to be surprising to most of them. The same change is possible in the purchasing of ties whenever maintenance officers will interest them sufficiently in the character of the ties purchased to take the necessary steps to bring it about.

THE SCRAP VALUE OF LABOR

Many materials can be used over and over before it is necessary to discard them. Even when their service life is exhausted most materials have a scrap value. But not so with labor. A man hour, when used, is destroyed in its entirety and its value is gaged only by what it has accomplished. If misused no part of it can be recovered and used again. Its value then is zero, for it has no scrap value. It should be clear, therefore, that those who direct the work of others must so plan their operations that full value may be received for every man hour expended and that none be wasted. This is particularly important this year when the supply of labor is far short of the demands and any loss incurred cannot be overcome by drawing further on the supply.

THE MAINTENANCE DEPARTMENT'S PART IN HANDLING THE PEAK TRAFFIC

THE AMERICAN Railway Association and the Association of Railway Executives are authority for the statement that the railways are facing the heaviest demands for transportation in their history. At a meeting held in New York on April 5 they drafted a program of action designed to secure the most intensive utilization possible of their facilities and thereby to increase their traffic handling capacities to the maximum. This program calls for the cooperation of every employee.

Because of the fact that they are not directly in train service, many maintenance employees fail to realize the importance of their opportunities to add to the capacity of their roads and some are, therefore, inclined to ignore a program such as this, thinking that it is of no concern to them. Rather, the reverse is true, for no department can interfere more seriously with the movement of traffic than the maintenance department if its work is inefficiently performed.

The opportunities for the maintenance of way department to add to the capacity of the railways may be divided into two general groups. In the first place, this department uses many locomotives and cars in the conduct of its work. In some instances this equipment is essential to the work of this department. In other instances, it is used because it is more economical under most conditions or because of long established habits. An analysis of work train operations will show that in many instances other methods can be adopted by the ingenious officer. The necessities of the cases now require that the use of work trains be reduced to the absolute minimum as the traffic increases. To prepare for this condition and at the same time to prosecute the season's program of work as vigorously as possible, motor cars, motor trucks on the highways, self propelling equipment and other expedients should be developed.

The other manner in which the maintenance of way department can contribute to transportation capacity is by bringing its facilities used in the handling of traffic and particularly in the movement of trains to a thoroughly effective standard of maintenance. While slow orders due to weakened track and delays because of ballasting, rail laying and similar operations affecting train movement may be minor in themselves, their result is serious in the aggregate. That maintenance officer will contribute most to the success of his road this year who so organizes his forces as to bring his facilities to the highest practicable stage of maintenance by those methods which will interfere least with the movement of traffic.

Letters to the Editor

IMPORTANCE OF THE HUMAN ELEMENT

Ysleta, Tex.

TO THE EDITOR:

I was very much impressed with S. E. Shoup's talk before the Roadmasters' convention, as published in the December issue of the *Railway Maintenance Engineer*. This article was not only practical but showed a keen insight into humanity. It was particularly timely because there is not enough down-off-the-perch contact of railway officers with their fellow laborers today. Too many officers lead themselves to believe that they are too busy to spend a few days each month in heart-to-heart talks with their section foremen out on the work, and prefer to handle their business by sharp-edged correspondence, which tends to lower the dignity of sensitive, well-meaning foremen. To develop a good, dependable section foreman, supervisors should give him to understand that he is a part of the road, and that they believe in him, and desire to confer with him rather than write him commanding letters. They will find that this will mean much to the foreman. A hearty wave of the hand from the rear end of a passing train means much to section men. It makes them feel that their efforts are being watched and appreciated.

I began railroading as a section laborer when I was 17 years of age. When I was 22 years of age, I was promoted to section foreman at $40 per month with plenty of extra time, but no pay for it. Later on I was made roadmaster, which I held for four and a half years, when I was given a position as superintendent of constructions, followed by five years as roadmaster, before I was compelled to seek a change in climate because of my health. During the entire 9½ years as roadmaster I discharged only two section foremen. After 25 years almost all of these section foremen are still there.

Personally, I never thought it paid to discharge section foremen if there was any way to avoid it. I am not saying this because I am now a section foreman, but am talking from personal observation and actual experience in handling men, as I found that it took from four to six months to get a new man lined up properly and if two foremen work the same section the same year little progress is made and the last condition is worse than the first. I found that by placing myself on a level with my men and by getting out on the work with them and exchanging ideas with them, they will do their best as a rule. Of course, they had their hobbies and weaknesses and made mistakes, but tell me of an individual who is perfect, and we will all go and see him. We all have our faults, so why quibble about some technicality or mistake. Few railroad men will make the same mistake twice. Because men are afraid of losing their jobs, when they do make a mistake if they can't cover it up they are almost sure to lie about it in some manner. So, I question if the "hard boiled" attitude pays in the long run.

As I see it, the better way is to make as few changes as possible, but rather to make friends of the men in your charge so they will swear by you. I find that the majority will go the limit to make good and to make your department a success and remain on the job satisfied. It takes a good new section foreman quite a while before he has all of the facts concerning his section at his finger ends. Sometimes, of course, foremen must be taken out of service; but as a rule, it is a mistake. The section foreman who feels that he is permanent and who knows more about his section and its needs than anyone on the division regardless of position, is invaluable to a railroad. When I was roadmaster if I had a foreman who was falling behind with his work, I went out with him and ascertained the cause, and arranged to help him in some way. It paid, for the foreman held his job and helped me hold mine.

I never criticised a foreman in the presence of his men, or wrote him a sarcastic letter, because I did not want to lower him in his own estimation. No official ever lowered his position by being a man among men, and if there was a general limbering up of officers toward their laborers, much trouble and unrest would be avoided, and the officers would render better service to their companies.

In conclusion, I want to say that the officers of the division on which I am working are of this type and the conditions to which I have referred are those which I have observed elsewhere while endeavoring to ascertain why the old time section foremen, who were so loyal that they would not trust a laborer to oil the hand car, have passed.

L. FLYNN,
Section foreman, Galveston, Harrisburg & San Antonio.

ADJUSTMENT OF RAIL EXPANSION

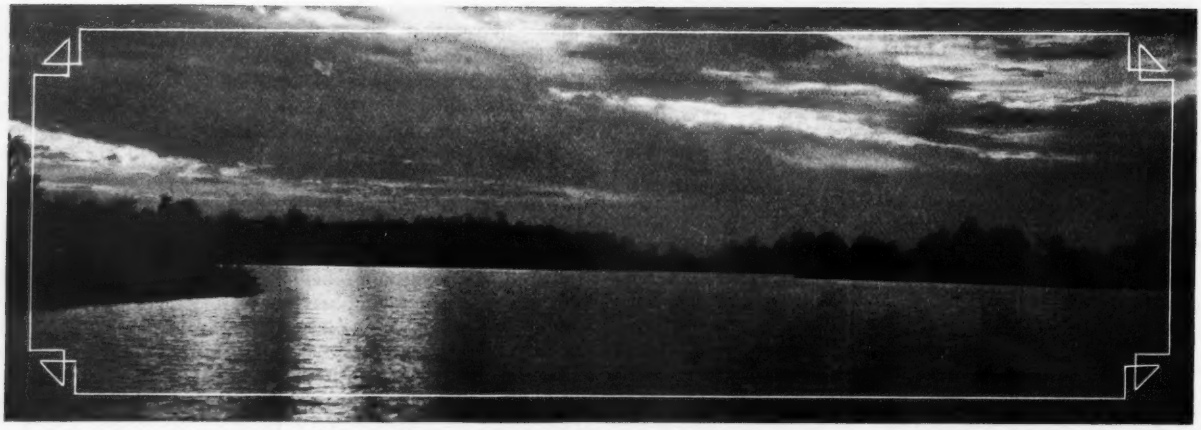
Pittsburg, Kan.

TO THE EDITOR:

After laying new rail so as to control the expansion in the manner suggested by J. Turman, roadmaster on the Kansas City Southern, in the *Railway Maintenance Engineer* for August, 1922, page 271, I have been convinced that expansion can be controlled if it is watched closely and work is started in time. Of course this means that the rail must be laid properly to start with and anchors placed close behind the laying. If rail is left over night without anchors and only half bolted or if fully bolted and the bolts left loose as is done in most cases with rail laying gangs, the rail will move one way or the other and thus lose the proper expansion until it becomes a hard matter to adjust it again. I watch rail very closely after it is laid and when a piece of track begins to tighten up in a sag, it is time to get busy with the track wrench. The rail will contract in the cool of the night and then when the sun begins to heat it in the morning, take a wrench and loosen the bolts on all open joints on the side or top of the hill, then strike the angle bars with a maul and the joints will close up, bringing the rail back up the hill. Keep this up from day to day until the joints fail to close when loosened, then tighten the bolts, reset the anchors snugly against the ties, and hold the rail where you have it. Another way is to loosen the bolts slightly at all open joints in the morning and then come back in the heat of the day and tighten them up again, when you will find them all closed up. Then reset the anchors on the ties. This operation should be repeated each week for four or five weeks, when the rail will be in good shape.

J. W. GRIFFITH,
Roadmaster, Kansas City Southern.

IMPACT RECORDER.—An instrument has been developed for use in box cars, which serves the double function of recording rough handling and detecting the time at which cars have been entered for pilfering. The time when the car is entered is recorded electrically by connections attached to the car door. Rough handling is recorded by a delicate spring and weight arrangement. The instrument is equipped with an eight-day recording clock movement, which carries a paper tape under the two recording pencils, one for recording the impact and the other the opening of the door.



The water supply at 33 points is obtained from reservoirs

How the Illinois Central Handles Its Water Service

Close Supervision and Complete Organization Lead to Unusual Efficiency in This Work

By DAVID A. STEEL

FOR SEVERAL years the name of the Illinois Central has been prominently associated with water supply work. The road is one of the pioneers in water treatment. It has been progressive in the application of electricity to railway pumping service and in the extensive use of centrifugal pumps, etc. Its water waste activities have also attracted considerable attention. These features, coupled with the fact that the Illinois Central has what is believed to be the oldest water service department of any large road and has departmentalized in this service to a greater extent than any other road, have led to the thought that the nature of its organization and the methods which it is pursuing will be interesting and valuable, particularly in view of the growing importance which is now being attached to this branch of railway service.

324 Water Stations Pump 15 Billion Gallons Annually

The Illinois Central-Yazoo & Mississippi Valley System comprises a total of 6,180 miles of lines. The main stem of this system extends from Chicago south to New Orleans, La., with numerous branches in Illinois, Kentucky, Alabama and the Mississippi delta. A line also extends westward from Chicago across Illinois and Iowa to Omaha and Sioux City on the Missouri river. Thus, the road traverses a country which is highly developed and which is productive of a freight traffic exceeding 17 billion ton miles in 1911, which, together with other traffic, required the expenditure for water service of $1,049,810 chargeable to operation and maintenance in 1922, and $325,000 for additions and betterments.

To handle this traffic, the road now operates about 1,800 locomotives. In 1919, these locomotives used 11,560,554,000 gal. of water. In addition 859,210,000 gal. was required for stationary boilers and 3,202,510,000 gal. for other purposes, making a total of 15,622,274,000 gal. pumped. Of this amount 3,614,512,000 gal. was purchased from municipalities. The water comes from various sources. The supply at 126 points is obtained from wells ranging from 2 grains to 60 grains hard, that at 141 points is obtained from streams, principally the Mississippi river and its tributaries, but including several fluctuating streams polluted with mine drainage, that at 14 points comes from lakes, at 10 from springs and the water at 33 from reservoirs, thus constituting in all 324 water stations. Of these stations 96 are supplied with city water and 34 stations are equipped with filtering or softening facilities which range in performance from 10,000 gal. per hour to 50,000 gal. per hour.

The Plan of Organization

The general plan of this organization is illustrated in the diagram. At the head of the department is the superintendent of water service, reporting jointly to the chief engineer and the engineer maintenance of way. On his staff there are, aside from a chief clerk and a stenographer, two inspectors, and the foremen of the system water supply gangs, which it is a practice of the company constantly to maintain. Two chemists also work in conjunction with the superintendent of water service although they report directly to the engineer of tests.

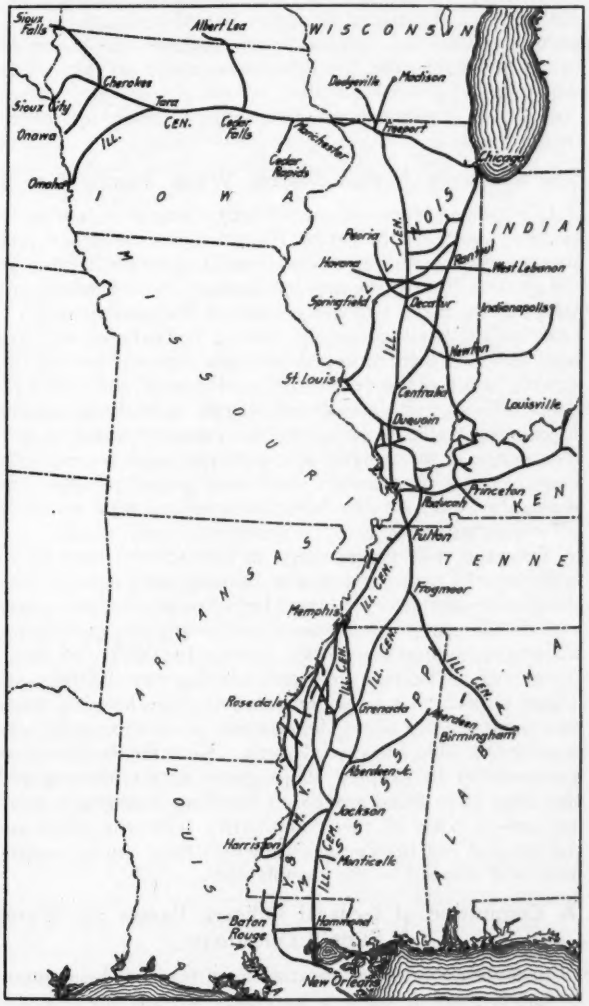
On each operating division, a supervisor of water service reports directly to the division maintenance officer (who on the Illinois Central is an engineer carrying the title of roadmaster) and indirectly also to the superintendent of water service. This supervisor of water service directs the work of the repair men, the pumpers, the treating plant attendants and the foremen of the division water supply gangs.

The authority of the superintendent of water service extends to all matters pertaining to water service of whatever nature. He checks and approves all estimates made for water service expenditures from any source and either makes or approves all recommendations before work is authorized. Where designs are required the details are worked out by the engineering department and approved by the water department. Where work is done under contract, all bids are handled by the department and the work is carried out under the supervision of the

department, either through the agency of a special inspector carried on the payroll of the superintendent of water service or by the regular inspectors. In addition all maintenance work is carried on under the supervision of the department, usually under the immediate direction of the division supervisor, and all requisitions for material required for water service other than the incidental repairs supplied by the division stores, are secured upon requisition of the superintendent of water service.

The Inspectors Work Up All Budget Data

It is the duty of the two inspectors to maintain general supervision over all phases of water supply work, including the program of new work as well as the operation and maintenance of existing facilities. They also act on special assignments, such as directing the movement of water trains when hauling water to replenish exhausted supplies. While they are qualified to do so, the inspectors make no chemical analyses of the water

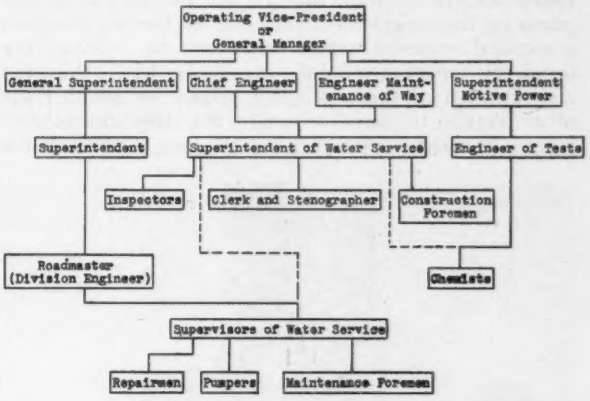


There Are 324 Water Stations On the Illinois Central

incident to treating plant operation, as this work comes under the jurisdiction of the chemists. As an important item of their work, however, these officers make a practice of inspecting all water stations periodically in conjunction with the division officers and reporting in detail on a printed form prepared for the purpose, the condition of the facilities and equipment with their recommendations for repairs and their estimated cost. These reports, submitted to the superintendent of water service form the basis of all budgets governing the monthly expenditures for water supply work of whatever kind during the following year.

Pumpers Do Their Own Testing

The responsibility for the proper treatment of all water subjected to chemical process rests with the chemists who are carried on the mechanical department payrolls. At the present time two chemists follow the water



The Water Service Organization

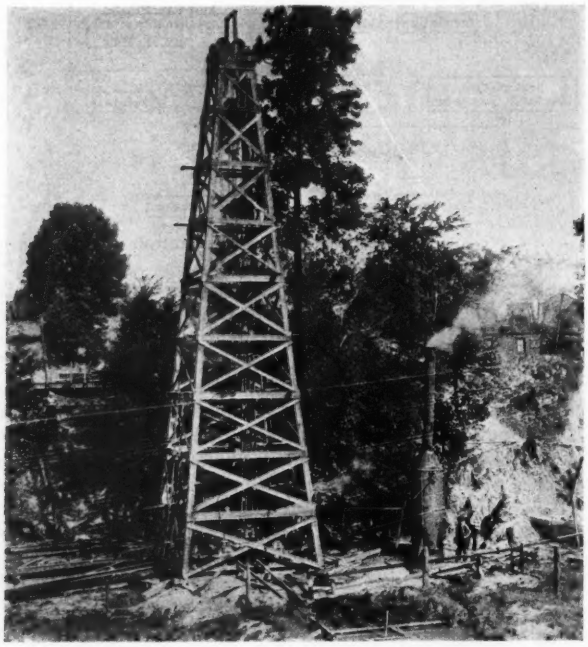
supply work, one spending the greater amount of his time in the laboratory, and the other traveling on the road. It is the duty of these chemists to make analyses of all water desired and to check periodically the work of the treating plant operators, each of whom is provided with testing apparatus for making a daily test of the conditions of the water in order to regulate the amount of chemicals. These chemists submit carbon copies of their reports to the superintendent of water service, giving the analyses of the raw and treated waters, the chemical dosage used in treating the water and other observations. In addition to this report the superintendent of water service receives records of all analyses of untreated water made in the laboratory for one purpose or another.

Much Responsibility Placed on the Supervisors

The division supervisors of water service have charge of division gang foremen, repair men and pumpers. They are responsible for the maintenance and operation of pumping machinery, tanks, fire hydrants, etc., in their territories. They are authorized to make requisitions on the division store for stock repairs and if the material is not carried in stock, they wire the superintendent of water service direct. If the work is within the scope and resources of the division forces, the supervisor undertakes it alone, whereas if assistance is required from outside, either because of the nature of the work or its urgency, he again communicates directly with the superintendent of the department. For use on their districts, practically all supervisors except those at terminals, are supplied with a tool car, while on three divisions they are provided with permanent water service outfits, consisting of tool, kitchen and bunk cars, all equipped with a view to the comfort and reasonable convenience of the men.

Among other things the supervisor is responsible for a monthly report filled out by all pumpers showing for each day of the month the number of tank feet of water drawn off by locomotives, the hours of pumping, the pounds of coal used, the oil used, the number of engines taking water (as determined from the telegraph

operator's report) and also the number of water cars filled or emptied, if any. From the treating plant operators the supervisor receives weekly reports showing the consumption of chemicals per day and per week, as well as the quantity of chemicals carried in stock. From the pump repairer (who, except in rare instances, confines his attention strictly to water supply repairs, leaving coaling stations and other equipment to other forces) the supervisor receives daily, a card showing his distribution of time and the materials used in effecting repairs. Independently of these reports of the repairmen and pumpers, the supervisor makes out for the storekeeper a prescribed material report whenever he receives material, this report showing the car number of the shipment, a description of the article, the requisition number and other details of similar nature for the storekeeper's record, a carbon copy of which is sent to the superintendent of the water service when the material is used in construction work or ordered by the superintendent of water service.



Operating a Rotary Drill On a Big Well Job

From these reports, the supervisor prepares on one form a monthly report for the storekeeper of all material used on his division, a second monthly report for the roadmaster (division engineer) of the labor distribution, and a third monthly report for the superintendent of water service showing the number of engines watered at each station, the pumpage, the pumpers salaries, other labor charges, the cost of material and the amount of supplies used. The supervisor is also responsible for keeping the stations stocked with supplies and the treating plants with chemicals, the latter usually being provided for on the basis of a 30-day run. In addition to this he must examine and submit a report to the superintendent of water service quarterly on the condition of all water tanks.

From the several supervisors' reports, together with the various reports and correspondence received from time to time, including all bills for city water, the superintendent of water service prepares the department reports and much statistical matter. These reports include an annual statement of all expenditures made for water service and of the work done. Statements are made of all water equipment on hand and its location. A card record is made of the consumption and cost of all city water supplied. Statements are prepared of the itemized annual and monthly estimates of expenditures to be made on each division for maintenance for the year following. Annual statistical statements are also prepared showing the cost of water per thousand ton miles, the cost of maintenance per station per year, the man hours of pumping and the pumpers at each point, the amount of overtime paid, the total man hours of labor engaged in water supply work for consecutive years, the cost of city water for consecutive years with the increase or decrease at each station, the coal consumed for consecutive years and the cost results and the estimated savings per year obtained from water treatment.

Copies of these statements are furnished other departments and serve the purpose of showing the condition and the accomplishments of the department as well as of providing a valuable basis for studies to increase the efficiency of the water service. For the use of the department itself this information is further supplemented by an unusually complete library on water service. The department also keeps files of all documents, maps, records of expenditures, etc., independently of other departments.

The Company Favors System Water Supply Gangs

It is the practice of the Illinois Central to maintain system water service gangs, the number of which varies somewhat according to the amount of work on hand. At the present time there are four outfits, two of which are well outfits, while two are organized for general service. One of the well gangs at present consists of a foreman and two men equipped with six cars and a drill for driving wells up to ten inches in diameter and 1,000 ft. deep. This outfit is engaged largely in making repairs to existing wells, cleaning shafts, renewing strainers, etc. The other outfit is specially equipped and is regularly employed for foundation work and gravel pit development, the water service department being called on to do all exploring work at such points.

The other two gangs range in size from 6 men to 40 with 6 to 10 cars for tool and housing purposes. These gangs are equipped for any kind of water supply work, one of the gangs for instance now being engaged in installing pumping machinery, laying 14,000 ft. of 8-in., 10-in. and 12-in. pipe line, and erecting two 100,000 gal. water tanks and two water columns. By keeping these gangs intact, the water department has skilled men constantly available for special work. No difficulty has been encountered in keeping these gangs profitably engaged and they have aided greatly in handling emergency work by reason both of their familiarity with the work involved and the readiness with which they can be assembled and shipped to the trouble area.

A Committee of General Officers Passes on Water Supply Questions

In addition to the organization within the department, a standing committee on water service has been organized. This committee consists of the superintendent of water service as chairman, the general boiler inspector and the engineer of tests. This committee was established in 1917 to handle problems which affected two or more departments jointly and to harmonize their viewpoints and coördinate their activities in matters affecting water service.

As an example of the business transacted, the committee at its last meeting discussed boiler compound with reference to its continued use on a certain engine

district and studied the question of either using a boiler compound or building treating plants on another section. At the same meeting it determined whether to use a non-scaling but a foaming producing water obtained at one station in preference to a scale forming but non-foaming water which was also available at that point. These meetings have eliminated much correspondence, have contributed substantially to the dispatch of work, the undertaking or success of which requires agreement of all parties, and have had the additional and important effect of avoiding controversies common to that condition of affairs where one department exercises its jurisdiction without first having arrived at a proper understanding with a department affected.

The Water Department Dates Back 30 Years

The organization of the water service department, except for the committee just mentioned, has continued in its present form for about 30 years. Prior to that time, each division was pretty much a law unto itself with respect to water supply. In general, it was the duty of the engineering department when orders were presented, to interest itself in the installation of new pumps, etc., and likewise the function of the maintenance department to pump the water and keep the machinery in repair. Neither of these departments concerned itself much about the work of the other, nor, having supplied the water, about how it was used. The only men who were chiefly occupied with the water supply work were the repair men and pumpers and, as might be expected under such conditions, the work of these men was not closely supervised.

When undertaking an extensive program for the improvement of its water supply facilities about that time, particularly in the vicinity of Chicago, brought on by the necessity for more extensive and reliable sources of water to meet increased traffic, it became apparent that the system under which the water supply was handled was faulty and a general foreman of water supply was appointed. His duties, while not clearly defined, were to acquaint himself with water supply conditions over the system, make recommendations for their improvements and supervise new work. The organization continued in this form for a few years until the personal request of the president that a study be made to determine the possibility of improving some of the water supplied, by treatment brought with it authority to employ a chemist and clerical help and generally to perfect a more complete water service organization. With practically no change, except to give the general foreman the title of superintendent of water service and to establish a clearer definition of responsibility among the officers comprising it, this organization has continued to the present time.

Water Waste Prevention Saves Half a Million

The work of the department which stands out most prominently is that of preventing water waste, close attention to this phase of the work having enabled the department to show a saving of a half million dollars in seven years or more than four times the entire expenditure incurred for the department. The interest in this phase of water supply began in a small way in 1914 and, like numerous other economies affected by the department, it is directly traceable to the practice of compiling handy statistical information. As mentioned earlier, the water supply at 96 of the 324 stations is obtained from municipalities at which the consumption amounted ot 3,614,512,000 gal. in 1919. These supplies are metered and paid for on bills issued monthly by these municipalities, showing the consumption and charges.

It so happens that the company's shops at Burnside, Chicago, are largely supplied with water from this source. In 1914 it was observed from the tabulated records of bills for water at Burnside, that the consumption at this point was increasing. Tests of the meters having confirmed the correctness of the bills, an investigation was set on foot to ascertain the cause of the increase. The findings were sufficient not only to warrant the permanent employment of a plumber at that point, but suggested the advisability of making similar investigations at other city water supply points. These investigations eventually led to a water waste prevention campaign over the entire system.

The results have been striking. Taking the records of all bills for water at 14 of the largest city water stations, the following tabulation of savings was arrived at for each of seven years at the 14 stations, which supply about 70 per cent of the total city water purchased.

REDUCTION FROM 1914 CONSUMPTION

1915	467,042,350 gal.	$ 27,910.53
1916	612,913,240 gal.	35,796.34
1917	360,565,900 gal.	20,746.72
1918	299,453,410 gal.	17,589.98
1919	364,206,930 gal.	22,272.10
1920	152,082,970 gal.	10,170.50
1921	419,047,885 gal.	35,846.34
	2,675,312,685 gal.	$170,332.51

This compilation shows that during seven years a saving of approximately $170,000 was effected on the face of the bills at the 14 stations. During this period the traffic increased 6,026,455,714 ton miles, or about 24 per cent as compared with 1914. On the assumption that the increased demand for water is at least one-half of the percentage of increased tonnage, it was estimated that the increased consumption at the above 14 stations during the seven year period was equivalent to at least 2,171,696,688 gallons, representing a cost of approximately $127,000, which, added to the saving of $170,000, gives a total known saving of $297,000. With this figure as a basis, it was estimated that the total saving in the cost of furnishing water alone during this period amounted to approximately $500,000 for the entire system, a saving which was brought about without any expenditure and without restricting the legitimate use of water.

One of the best examples of the results of this campaign for the prevention of water waste is furnished in the conditions found at one of the large office buildings, where, as a result of a water waste survey, the annual water bill was reduced from $2,981 in 1919 to $1,965 in 1920, representing a saving in excess of 30 per cent, the figures for the month of October, in fact, showing a decrease in cost from $419.38 in 1919 to $182.82 in 1920, or 60 per cent.

The water waste disclosed itself in various forms and its discovery usually led also to substantial savings in other ways than the cost of water alone. In the office building just mentioned, for instance, the water waste was caused chiefly from improperly adjusted flush tank valves in toilet rooms and an improperly working feed water heater valve, the latter resulting not only in an excessive charge for city water, but also in the loss of coal required to heat the additional water, and of electricity required to pump the additional water from the basement level to the city sewer through which it was wasting. At another point the losses were such that their discovery and prevention made unnecessary a contemplated expenditure of $18,000 to enlarge the water station.

The methods which were adopted and are still pursued in preventing water waste are not confined to the

vigilance exercised by the department forces themselves. Much reliance is placed upon the effect of educational work directed to the end of impressing the significance of water waste upon everybody having occasion to use water. This educational work is done by personal contact, by literature periodically prepared in the form of letters, articles published in the employees magazine and campaign posters. The most recent development along this line is a stamp which is impressed upon all inter-departmental correspondence. Supplemental to this work, all city meters are read in the presence of the division supervisors of water service, the bills which the supervisors approve are checked by the superintendent of water service and any irregularities appearing when comparisons are made with previous records are brought to the attention of the division officers. If the irregularity cannot be explained satisfactorily a survey is then made on the ground.

Fuel Saving Studies Also Proved Profitable

Since the water waste prevention work was begun, similar studies have been made in other directions. Among these the consumption of coal by the department has received careful attention. With 158 of its water stations using steam power, the coal bill regularly constituted a large item of the department's annual operating expenditures. As no conspicuous indications of excessive waste of coal had arisen for several years, this phase of the water supply work had received no great amount of notice other than to see that coal was provided and ashes removed.

It was the office records again which suggested the possibility of effecting a saving in coal bills. As shown by the figures below, the accounting records for 1917 disclosed an 8,000 ton or 20 per cent increase in consumption and about a $35,000 or 90 per cent increase in the cost of coal over the figures of the previous year, and a still further increase for 1918. As these increases did not appear to be justified, the use of coal was made the subject of an investigation.

COAL CONSUMPTION AND COST

	Tons	Cost	Average cost per ton
1915	46,580	$ 51,998	1.12
1916	40,168	41,374	1.03
1917	48,051	76,605	1.60
1918	50,078	115,289	2.30
1919	40,860	110,710	2.70
1920	42,340	135,293	3.19
1921	37,498	126,723	3.40
1922	40,917	133,920	3.24

The coal used is principally screenings, this quality having been adopted in earlier years because of the large difference in its cost as compared with that of lump or mine run. The investigation disclosed, among other things, that for some time it had been the habit of the divisions when having surplus coal on hand to unload as much as 10 months' supply at the pumping stations with no thought to the susceptibility of the screenings to deterioration, and that actually in the fall of 1917 and 1918 and large quantities of screenings were dumped at stations much of which deteriorated from exposure to such an extent that it could not be used. The investigation also disclosed the fact that inferior grades of coal had been used at some stations, necessitating the use of from 40 to 60 per cent more of it. It was also found that the lack of an accurate method of checking and charging out coal led to guesswork on the part of the division accountants when making charges.

To correct the conditions, orders were issued forbidding the storing of more than a three months' supply at any plant and more attention was given to the selection of coal and to the possibility of profiting by watching market trends. Also at many places power plant improvements were made, among which was the application of more suitable grate bars for burning the finer coal and chief among which was the installation at the larger plants of feed water heaters, of which there are now 35 or 40 in service. These feed water heaters, by utilizing the exhaust steam from boilers for pre-heating the feed water, are estimated to save at least ten per cent in the fuel bills at the stations equipped.

As a partial result of these studies, at least, the consumption of coal dropped from 50,072 tons in 1918 (the year in which the fuel saving campaign was undertaken) to 40,850 tons in 1919, or about 22 per cent, and the cost

A Water Waste Stamp Goes On All Letters

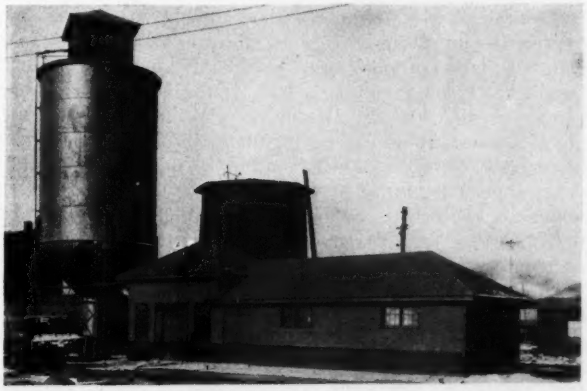
dropped from $115,289 to $110,710, representing an actual saving of about $5,000, in spite of the fact that the price of coal per ton was 50 per cent higher in 1919 than in 1918. It will be noted from the above figures that the consumption increased in 1920, dropped to the low figure of 37,498 tons in 1921 and again increased to 40,917 tons in 1922. This figure, however, is still less by about 10,000 tons or 20 per cent than the consumption in 1918, in spite of the fact that since 1921 alone, traffic had increased about 30 per cent. The larger cost of coal since 1918, of course, is explained by the increase in the cost per ton, it being significant to note that if as much coal had been used in 1922 as was used in 1918, the coal bill would have been about $94,000 higher than it was. This estimate also disregards an increase that could easily have resulted from the substantial increase in traffic since that time. As it was, the cost of the coal itself was somewhat decreased by taking advantage of the smaller differences between the cost of mine run coal and screenings to use more of the better grades for water supply work.

Water Treating Savings Exceed $220,000 a Year

Some mention has already been made of the department's activities in water treatment. While the Illinois Central is more fortunate than some roads with respect to the quality of its water, having only a few supplies that may be considered extremely bad, the possibilities for effecting economies and improving train operating conditions by getting good water were early appreciated by the company with the result that special care has been exercised in selecting suitable supplies and continued support has been given to the establishing of purification processes, where it has not been possible or practicable to secure naturally suitable water.

The first treating plant was built in 1900, and at intervals since, other installations have been made until, with the building of nine new plants last year and the rebuilding of three others, 34 are now in operation, five of which are filter plants. According to present plans this number will be increased to 40 by the building of six additional plants during the current year. In general it has been the policy to proceed with the installation of the treating plants on a conservative scale, treating the worst water first but at the same time with a view to equipping entire districts in order to get the increased benefit of a uniform grade of water. Proceeding on this basis, three adjoining engine districts extending from Freeport, Ill., to Omaha, Neb., a distance of over 400 miles, are now completely equipped, while the two districts between Freeport and Clinton, Ill., will be equipped when the stations now under construction are completed this year. It is interesting to note that in promoting the improvement of water supplies the merits of boiler preparations either alone or in conjunction with exterior processes have not been overlooked, and also that the department has realized the importance of constant supervision of the treating plant operations as well as the possibilities of remodeling facilities that have been found deficient in design or inadequate in size.

The benefits resulting from this work have been many and substantial. While the intangible nature of some of the effects of the water treatment and the scattered condition of some of the plants have made it impossible to compute the value of the work directly, the figures for 1921 show that in treating 1,130,591,000 gal. of water, ranging from 11 grains to 40 grains per gallon hardness, the 20 plants that were in operation, representing an investment of $247,801, removed 2,423,900 lb. of scale forming matter from the water treated, which, on the basis of findings made by the American Railway Engineering Association, represents a net saving to the company of $220,100, or over 90 per cent on the investment in these facilities. This saving is limited to the value of reductions effected in the amount of fuel required by locomotives, the flue renewals, the amount of flue calking and other running repairs and the time lost by locomotives while undergoing repairs attributable to water. No figures are available as to the value of water treatment from the standpoint of improved train operation, except perhaps the statement that the average performance of power during the last five years has been over 1,000,000 engine miles per failure in treated water territory, a performance considerably greater than that characterizing the period prior to the establishment of water treating facilities at the points of the worst water. The beneficial effect of the water improvement work from this standpoint is also indicated by the fact that, prior to the establishing of the first treating facility on the Minnesota division, it was necessary to keep one engine in reserve to protect live stock shipments, owing to the unreliability of the service by reason of bad water conditions.



The New Treating Plant at Council Bluffs, Iowa, Is Typical of the Plants Built in 1922

Much Attention Given to Provision of Reliable Water Supply

In the early days of the department the work was principally that of removing the uncertainty that existed about getting water because of unexpected failures in the equipment or lack of adequate supplies. With the rapid increase in traffic that has taken place, this has continued to be a principal outlet for the department's usefulness. Only recently the department had occasion to undertake one of its largest projects of this character in the vicinity of the coal fields of southern Illinois.

The Building at Lake Cormorant, Miss., is the Standard Frame Pump House

In this instance, the road faced a peculiar situation in that a series of shortages sufficiently acute to require the hauling of water in trains for considerable distances, not only presented a serious obstruction to the free and economical movement of trains, but also threatened to curtail the production of the mines in the vicinity which furnished the traffic for the road. The problem was further complicated by the extent of the area affected and by the scant promise which the natural resources apparently afforded of any easy solution of the problem, as indicated by the fact that it was necessary to haul water a distance of 50 miles to prevent the exhaustion of the supply at one station. At Du Quoin, for instance, where about 75 per cent of the shortage occurred, there was no creek from which to get a supply, the quality of the ground water made its use out of the question and the watershed could not be relied upon for a sufficient supply to warrant deepening the existing reservoir. Again at Bois, further north, the creek could not be relied upon to supply the demands and the watershed had already evidenced its unreliability and in the mine district the creeks were polluted with mine drainage and the town supplies themselves were running low.

Under the direction of the water supply department, however, not only was the problem of shortage over the entire district satisfactorily solved at a cost of only $240,000, but provisions were made under which greatly improved water is obtainable at the point of largest consumption and under which, also, the production of the mines is protected and a considerable source of revenue

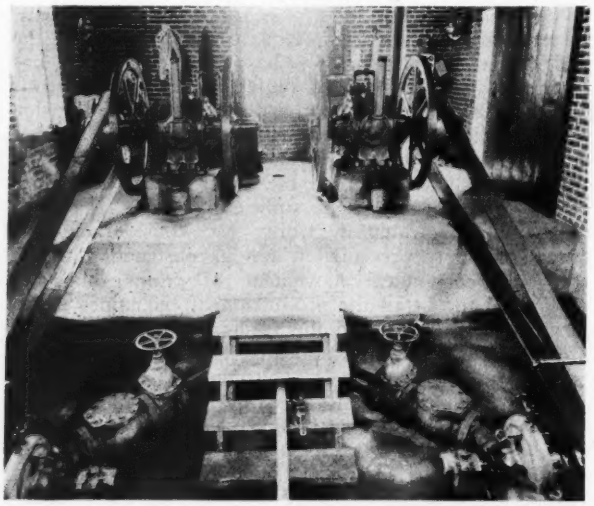
afforded through the sale of water to those industries and to other roads.

This was partially accomplished by putting in a new reservoir and pumping station at one point. At another point the expense of a new reservoir was avoided by an ingenious adaptation of an old reservoir to the habits of a nearby stream. At another point, a temporary plant was recommended and at another, water facilities were remodeled, and throughout the undertaking advantage was taken of the possibilities of utilizing salvage material from one point for installation at another.

With respect to the facilities in existence, the success of the department in preventing failures has been brought about largely by a strict adherence to the policy of looking to the repair of equipment before breakdowns occur and in making such repairs as will protect the system from the necessity of emergency work, a policy which has also been instrumental in cutting down much of the overtime and generally in reducing maintenance costs. As an indication of the success achieved in this work, the cost of water per 1,000 ton miles of freight was slightly under three cents in 1922, as reported to the Interstate Commerce Commission.

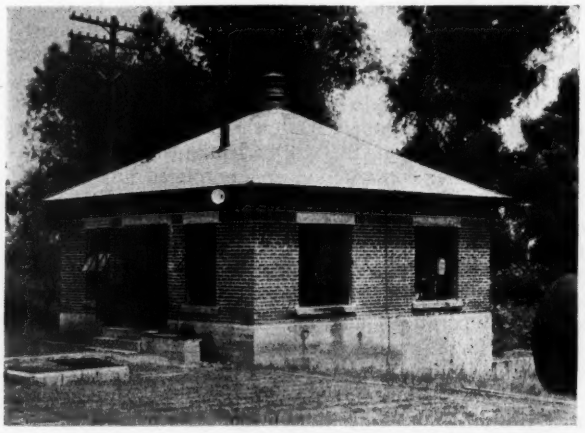
Maintenance Expenditures Regulated by Monthly Budgets

Indirectly the budget system under which all water supply maintenance work is done, while having as its main objective the promotion of regularity and economy in the conduct of the maintenance work, is an important factor also in promoting the reliability of the water service. This budget, which is a maintenance budget as distinguished from the more common budget for additions and betterments, is prepared during one year for use during the following year in determining the amount of money required each month at each station for operation and repairs. This budget is made from information furnished by the inspectors who determine on the ground and in company with local officers, the exact condition of each facility, not only with a view as to its present condition but as to the necessity for repairs and when they can best be made. According to this plan, if it authorizes an expenditure of $400, for instance, for new tank hoops at a certain point and during a certain month, the division officer has definite knowledge of what he can spend during that month as well as knowledge as to the character of the work to be done. This practice has the effect of acquainting the department with the condition of every structure in advance of the time repairs may be needed and is beneficial in providing for the repairs according to a systematic program.



The Department Favors Duplex Pumping Units

As a further precaution to protect the water supply from failure at any time, each supervisor of water service has been required in recent years to make an examination and report every three months on all water tanks on his division. This practice was instituted following an epidemic of tank failures and it is significant that during the 10 years since this practice was adopted, there have been no tank failures nor any interruptions to traffic arising from this source.



The Standard Brick Pump House is Fitted With Steel Sash and Doors

Fire Losses Reduced 60 Per Cent

Records over a period of years having shown an unexpectedly large proportion of failures and losses in water supply equipment as being attributable to fires, considerable attention has also been given to fire prevention work. Specifically the records showed that during a 10 year period preceeding 1918 the pump house fire losses exceeded $33,000, in addition to those arising from interruptions to traffic caused by failure of the water supply because of fire. Records further showed that 13 of 17 tank fires occurred in winter, chiefly from accidents when attempting to thaw frozen pipe lines.

One method of meeting this problem has been to give attention to fireproof construction and further to take precautions to prevent the freezing of pipe lines around such buildings. In addition, the department has adopted the practice of notifying the division superintendents whenever fires occur on their divisions, or upon other divisions. In the Fall of each year each division's attention is also called to the importance of fire prevention measures. That efforts in this direction have been successful is indicated by the fact that fire losses have been reduced over 60 per cent since starting these practices.

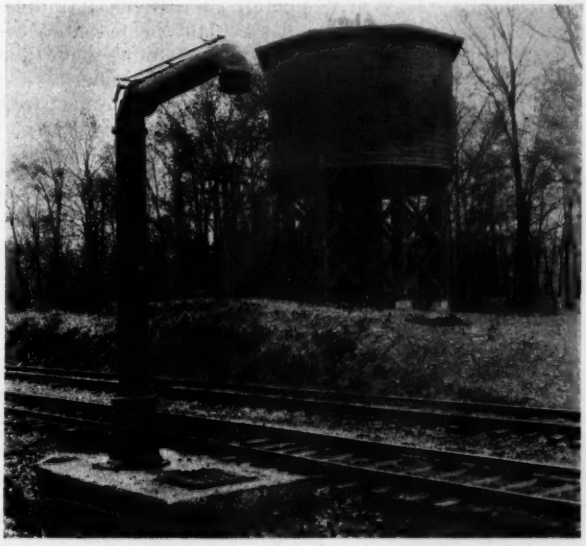
As another method of forestalling failures in equipment and insuring reliable service from the water supply, it has become the practice of the department to install duplicate pumping units in all important points. The arrangements include a duplication of the power unit as well as the pumping unit and the making of provisions for the operation of one unit independently of the other. At the present time between 50 and 60 stations are equipped in this manner. While the practice necessitates additional initial expense for equipment, amounting to about a 15 per cent increase in the total cost of the facility, this practice is believed to be justified by the security

afforded at the important stations against interruption arising from a breakdown in equipment and the opportunity to make better repairs to equipment without at the same time entailing increased expense for overtime work. At some points there is also the additional advantage of an increased pumping facility to handle temporary overloads that occasionally arise from one reason or another.

Promoting Economy by Permanency in Construction

One practice of the department, which has operated not only to promote reliability of service but also economy in the operation of the water supply facilities, is that of striving for permanency in the character of all new work under construction. The water supply buildings show this characteristic. The company's standard pump house, for instance, is of brick construction, invariably built on concrete, provided with concrete floors and fitted with steel doors and sash. This type of building is attractive and is only slightly more expensive than cheaper forms of construction, while it affords the added advantage of requiring practically no maintenance and affording a protection from breakdowns because of fire. While this construction is standard, it is not followed in all cases, several water supply buildings having been built recently of frame construction owing to the greatly increased cost of brick over frame in the locality where the buildings were required.

The company has gone into the use of creosoted timber tanks extensively for supplies not requiring more than 100,000 gal. storage. For this purpose loblolly pine,



All New Supply Tanks Are Built to Serve Locomotives Through a Water Column

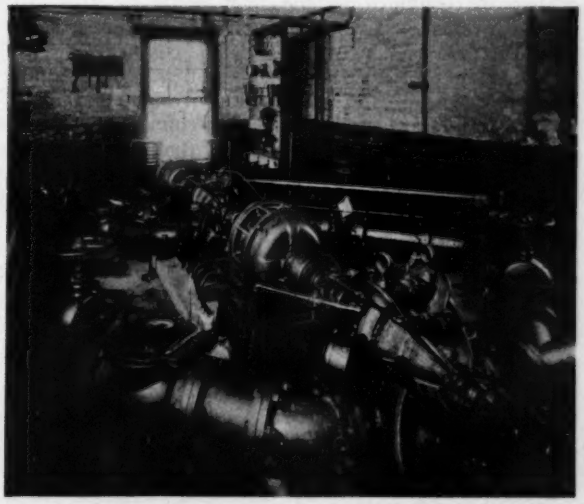
grown tributary to its lines, is creosoted after being framed and prepared for erection by company forces. These tanks are economical in first cost and in maintenance as they do not require painting. At the present time over 40 creosoted tanks are in service. Steel tanks are also used extensively.

The department has also adopted the practice, when providing new or replacing storage tanks, of erecting these tanks a considerable distance from the track and installing water columns for the delivery of water to the locomotive. This construction makes it unnecessary to shift the tank when making track changes and permits the watering of locomotives more rapidly than can safely be done from the tank spout.

It has become the practice of the department also to plan for the future when laying pipe line, a practice which is supported chiefly because of the permanency of the construction secured at a comparatively small additional expense and the lessened expense required for the operation of the pumping equipment by reason of the lower resistance of the larger pipe used.

Reducing Man Hours by Careful Selection of Equipment

In the beginning of this article, mention was made of the progress shown in the application of electricity to pumping and the extensive use of the centrifugal type of



The Electric Installation at Kankakee Saves the Cost of Two Pumpers

pump. This equipment and also the oil engine has received a great deal of attention from the department chiefly because of the possibilities its use affords in reducing the cost of attendance, the largest item of expense in the operation of the water supply facilities.

The experience at Kankakee, Ill., is an example of what the department has accomplished in this direction. At that point it became necessary to enlarge a steam operated station and after careful study it was decided to replace the steam plant with an electrically operated system with centrifugal pumps. Aside from the small initial cost of the equipment over that of additional steam facilities, the installation of the electric power unit made unnecessary an increase in the size of the building and its automatic operation permitted a saving to be effected in the cost of two pumpers and in addition about $60 per month in the cost of handling fuel and making repairs. At another pumping station the replacing of a combined steam and gasoline engine unit requiring two pumpers by automatically controlled electric equipment made it possible to place the operation of the unit under the supervision of the coal chute foreman.

At the present time there are 11 electrically operated stations in service and 28 oil stations, some of which have been installed to replace steam or gasoline operated plants which required reconstruction and others to modernize stations which studies, based on man hour and unit cost records, showed were operating so uneconomically as to justify the change. Ordinarily, the department will recommend the remodeling of a station when the change will effect at least a 10 per cent saving. In making these replacements or otherwise remodeling stations, each problem is considered individually in the light

of the surrounding circumstances rather than according to any standard requirements as to the power or similar equipment. According to this plan electric power has been installed at one point while oil service has been established at another and at other points it has been decided merely to remodel the existing steam plant. One factor which governs the use of electricity is the degree of reliability of the power available. Where an electrical installation is made where the source of power is not absolutely reliable, it is the practice usually to keep the old equipment in shape for emergency use. Frequently electric power, while accessible, is found not to be justified because of its cost.

As a guide in conducting these studies, the records which are compiled of the man hours of attendance and of overtime have been valuable. These reports, studied in connection with the unit cost of operating pumping stations, as furnished monthly, afford an immediate index of the advisability of making changes. These records are used regularly in connection with the department's work, with the result that substantial reductions have been made in the cost of attendance over the system, the number of man hours having actually decreased from 475,570 in 1920 to 392,284 in 1921 or 18 per cent.

Another effective means by which these costs have been reduced has been by the adherence to a practice of installing additional storage tanks wherever it holds out promise of accomplishing substantial results. It has been found that the increased cost of these tanks over a smaller tank is often easily overbalanced by the saving in the cost of attendance required to maintain a supply of water, particularly at outlying points. Thus, the installation of an additional 100,000 gal. storage tank costing $4,500 at a certain steam plant effected a net saving of $1,050 per year or a return of 23 per cent on the investment made, by reducing the number of pumpers required and by decreasing the amount of fuel required because of pumping a shorter period.

The Illinois Central, in common with other roads, has been confronted with the problem of overcoming the decreased capacity of pipe lines due to incrustants on the interior. This accumulation was sufficient in many cases to not only increase the cost of pumping but to interfere otherwise with the operation of the facilities. As an alternative to the reconstruction of these pipe lines recourse has been had to methods of cleaning them, with beneficial results. At Carbondale, Ill., for instance, the cleaning of one section of a pipe line enabled the coal consumption for pumping to be reduced 722 tons per year, which alone was equivalent to a return of 110 per cent on the cost of cleaning. At another point, the cleaning of a pipe line resulted in an annual saving in fuel of $2,200 per year, while at Hallidayboro, Ill., annual savings of $900 in fuel consumption and $250 in labor charges for repairs were effected.

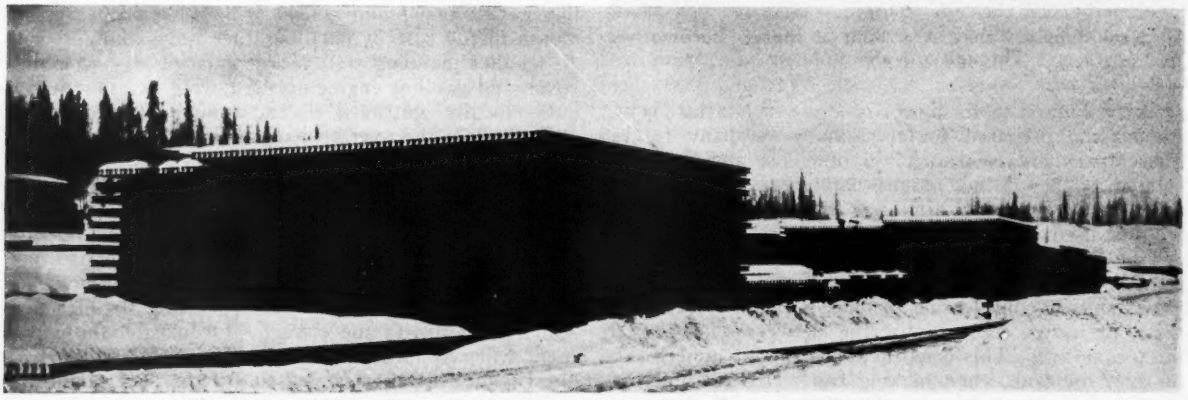
A Close Contact Kept With Purchasing Department

Typical of subjects of lesser importance which have received the attention of the department but which are nevertheless deserving of consideration as elements in the department's general scheme of promoting economy, are the subjects of valve care, and the co-operation with the purchasing and stores department and with municipalities from which water supplies are obtained. In the case of the valves, for instance, it was found that during 1920 and 1921, the Illinois Central purchased 22,359 globe valves alone at a cost of $80,083, which is equivalent to the purchase of 37 new globe valves daily at a cost of $135.47. With a knowledge of the misuse to which this equipment is subject and the loss resulting not only in the wear and tear on the valves but indirectly from leakage through valves, the department has endeavored to promote the greater care of valves, both by inspecting the condition of valves on the ground and by means of literature dwelling upon the importance of valve care and the proper methods of handling them.

The municipalities from which water supplies are obtained have come in for their share of attention in various ways. The department has always made it a practice of informing itself thoroughly with respect to municipal water problems as affecting the Illinois Central, has held itself always ready to co-operate in matters of mutual interest, and in many cases has actually helped cities develop their supplies, especially where studies have disclosed the economy for the company in so doing.

Finally a close co-operation and continued contact with the purchasing and stores departments, chiefly as an incident of the department's jurisdiction over requisitions for water supply equipment but in other ways as well, as been fruitful of substantial savings in the purchase of such equipmnt and in contributing to the dispatch with which the supplies have been obtained. It has also had a beneficial effect in the better service obtained from equipment selected upon recommendation of the department with a knowledge as to the use for which it is intended.

The methods described above have been developed largely under the direction of C. R. Knowles, superintendent of water service of the Illinois Central, reporting to F. L. Thompson, chief engineer, and A. F. Blaess, engineer maintenance of way.



Rail in Storage at Anchorage, Alaska, for the Government Railway

How Much Thought Do You Give to a Plan for Your Work?

In the Opinion of Mr. Fritch, Personal Efficiency Is Largely a Matter of Following a Definite Routine

By WALTER S. LACHER

IF YOU WANT to be sure to get some work done give it to a busy man. The truth of this oft-repeated comment is generally accepted, but it constitutes a paradox that can be carried one step further by asking a busy man to explain it.

"It depends upon what you mean by a busy man" was the reply of Lewis Charlton Fritch, vice-president of the Chicago, Rock Island & Pacific. "In my opinion a busy man is one who is given lots of work to do because he gets it done. He is able to do this because he works hard and also because he carries on his work according to some prearranged plan. Such a man, when called on, can usually take over additional work by fitting it into his program."

"But is not personal efficiency an important factor?"

"In my opinion" he replied, "personal efficiency is largely a matter of following a definite routine, of concentrating on one thing until it is cleaned up. The man who says, 'Well, I don't know, I guess I will let this go for a while,' will not get as much work done as the one who stays with each problem until he can dispose of it definitely."

L. C. Fritch
Vice-President, Chicago, Rock Island & Pacific

"Mr. Fritch observes this rule most religiously," said a former secretary of his, "If you give him the facts, he will give you his answer, yes, or no, and what is more, I don't know anyone who practices greater concentration. He is not only exceedingly fast at dictation, but he will often dictate as many as 20 letters without referring to correspondence or notes of any kind. I have seen him interrupted in the middle of a sentence in a long letter, and then, after an interval of several minutes, go on just where he left off without asking to have the sentence read. I never met a man who could go through a long report quicker than he can, and yet he always seemed to grasp what was in it."

There would appear to be a direct relation between this power of concentration and the circumstances surrounding Mr. Fritch's course in civil engineering at the University of Cincinnati, although it is impossible to say which was the cause, and which the effect. Entering the service of the Ohio & Mississippi railroad at the age of 15 as a roadmaster's clerk he soon developed a keen interest in railway engineering, and in due course obtained a transfer to the office of W. B. Ruggles, chief engineer, under whom he served as a helper for the assistant engineer on general maintenance of way engineering. The work was fascinating but he was not long in coming to the conclusion that he needed more education, and after conferring with Mr. Ruggles, he took up work in the university on a part-time basis, putting in substantially one half day in classes and the other half with the railroad. This arrangement obviously called for an enormous amount of night work, even with the most rigid time economy.

"Of course my railroad work often interfered with this plan," explained Mr. Fritch, "especially if I had to go out on the line, so naturally I missed some of the classes. It was a hard schedule at best, but I was glad to have the opportunity to take the university work and have always felt very much indebted to Mr. Ruggles and to his successor, C. C. Chandler, for permitting me to go on with my railroad work according to that arrangement."

Four years brought a diploma and with it a chance to end this arduous double service, but instead of welcoming such a respite, Mr. Fritch immediately started to study law and did not cease his efforts until he passed the bar examination.

"Do you feel that you profited by this study," I asked, "and would you advise a young man in railroad service to take up studies or reading so far outside of his particular line?"

"There is one common fault among the subordinate maintenance of way officers which applies with almost equal force to those that have had the advantage of technical training. They do not make enough effort to broaden their knowledge of railway matters, and of business in general. Of course, the great opportunity for the

engineer in railway service arises from the fact that so large a part of the business of rail transportation is related to engineering in one way or another. Even train operation is in many respects a matter of engineering and in my opinion the railroads have suffered from a lack of technically trained men. But the man who has ability in one of these special lines must not stick too close to his specialty. He should broaden his view point and, in particular, he should consider his own work from the standpoint of business requirements. Too many engineering and maintenance of way officers feel that all the work done under their direction must conform to the highest standards. They do not give enough consideration to the purpose for which the work is being done, and the relation between that purpose and the amount of money which the railroad would be justified in spending."

That Mr. Fritch gave a great deal of thought to the business or financial side of railway problems is brought out in a review of his railway career as he outlined it briefly.

"In 1892, I succeeded to the position occupied by Mr. Chandler as chief engineer and master of maintenance of way of the Ohio & Mississippi and was also made chief engineer in charge of the construction of a branch line known as the Cincinnati & Bedford. A year later the road was absorbed by the Baltimore & Ohio Southwestern, and in the reorganization that followed, I continued in my old position but with the title of division engineer of the Mississippi division. Six years later I was promoted to superintendent of the same division. In 1904, I. G. Rawn, who had left the Baltimore & Ohio to join the Illinois Central organization, offered me a position as his assistant on special work and in 1906 when Mr. J. T. Harahan was elected president of the road, he wanted an assistant on financial matters, reports and various other problems, and I was given the position on Mr. Rawn's recommendation. In March, 1909, when agitation in Chicago for the electrification of all the railroads in the city was at its height, I was appointed consulting engineer to study that problem.

"Late in that year Mr. S. M. Felton, who had been made president of the reorganized Chicago Great Western property, asked me to become chief engineer and for the next 5 years I was responsible for extensive improvements to property, including second track work, grade revision, terminal development, etc., as a part of an $18,000,000 program for the rehabilitation of that road."

"I suppose that your interests continued to lie along the line of operating or financial matters?" I interjected.

"Yes, I think every engineer should always keep in mind the relation his work bears to the main object of the railroad—transportation. It is only by doing this that he can hope to prepare himself for an operating position."

The influence of this attitude is reflected in Mr. Fritch's subsequent career. In 1914, he was appointed assistant to Sir William MacKenzie, president of the Canadian Northern, and in August, 1915, when the lines east of Port Arthur were opened for operation, he was made general manager. Later he became general manager of the Seaboard Air Line, and since October, 1918, has been vice-president of the Rock-Island System, in charge of construction, maintenance and capital expenditures, and more recently also of operation.

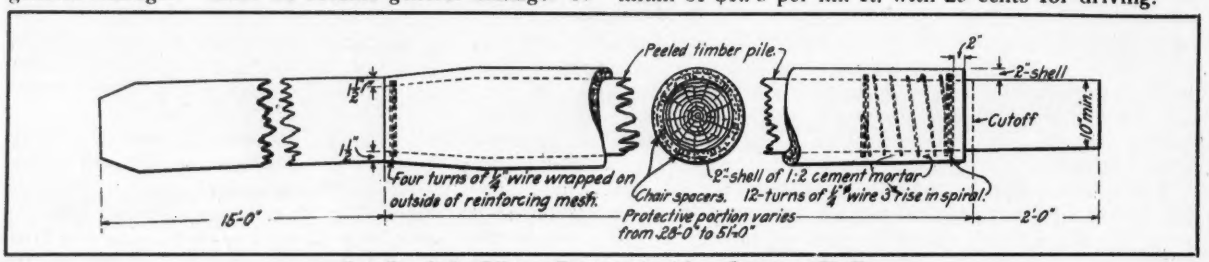
Mr. Fritch has taken an active interest in railway associations, particularly the American Railway Engineering Association, with which he has been prominently identified since its organization. He was one of the small group of men who laid the plans for the association in 1897, and in his position as secretary for the first seven years following its organization in 1899, performing a service which was an important factor in giving it the initial impetus which is reflected in the high standing it enjoys today. In 1910 he was made president of the association. His opinion on the advantages of membership in the technical associations of railway men is therefore pertinent.

"Active participation in the work of these associations" he said, "exerts a broadening influence on any man, entirely aside from what he gains in the way of technical knowledge. It will tend to increase his self confidence and will help him to put his best foot forward."

A Coating to Protect Timber Piles from Borers

THE PORT of Tacoma, Wash., has developed a type of protected piling to overcome the attacks of marine organisms which is somewhat unusual in its design and construction. In developing the design, studies were made of existing cement coated and reinforced concrete coated piles and a tentative design developed. In this tentative type, the coating consisted of a 2-in. shell of cement mortar applied with a cement gun over a peeled timber pile reinforced with a double spiral wrapping of 2-in. mesh poultry wire and vertical lines of ⅜-in. rods. This form of pile failed in some of the tests.

The design shown in the illustration was then adopted. This pile has a two-inch cement mortar coating reinforced with one layer of No. 12 gage, 2-in., welded mesh wire with additional reinforcement at the ends of the protective coating in the form of spirals of ¼-in. wire. The piles are driven butt down, the ends being sniped for easy driving. No coating is applied on the first 15 ft. as this section is driven below the ground line. In order to secure a smooth joint between the pile and the coating, the piles are dapped circularly to a depth of 1½ in. and this dap tapered out to the surface of the pile. The thickness of the coating is tapered down to 1½ in. in order to line up with the 1½-in. dap. A predetermined length of the pile is left uncoated on the pile head for driving purposes. A piece of tarred paper is placed over the end of the pile and the joint thus formed with the cap is thoroughly covered with the cement mortar. The cost of this work at Tacoma, including everything, is indicated by the bids which were received and which ranged from $1.08 per lin. ft. with 15 cents for driving to a maximum of $1.73 per lin. ft. with 25 cents for driving.



Details of the Pile as Protected with a Concrete Shell

Cutting Down the Work Train Costs

Suggestions For the Development of Other Methods to Release Equipment for Revenue Service

THE RAILWAYS are now handling a traffic greatly in excess of that at this season of any previous year. At no time since last September have there been a sufficient number of cars available to meet the requirements of shippers. This shortage of cars is, in part, due to a lack of locomotives. The importance of restricting the use of locomotives and cars to actual necessities for work train and other non-revenue service is self evident, particularly in view of the certainty that the demands for transportation will increase rapidly as the season advances.

To meet this situation, The American Railway Association and The Association of Railway Executives formulated a program on April 5th which includes among other recommendations, the following:

"That all interested be impressed with the necessity for loading all cars to maximum capacity in an effort to bring the average loading to 30 tons per car for the entire country; for unloading cars promptly; increasing storage facilities where necessary and providing adequate siding capacity to facilitate loading and unloading, thereby increasing the number of available cars.

"That the use of power and equipment for railroad construction and maintenance purposes be restricted to the minimum after September 1 in order that a maximum of power and equipment may be available for commercial purposes."

Because of the importance of this subject to the railroads and the public alike, and the contribution which engineering and maintenance of way officers can make to this campaign, we publish below two discussions of this subject which are of special interest at this time.

Study the Work to Be Done

By F. W. HILLMAN
Division Engineer, Chicago & North Western, Chicago

The economical use of work trains is a question which concerns not only the track forces but also the bridge and building, signal, telegraph and construction gangs as well. In the past it has been quite the practice for roadmasters and bridge supervisors to put on work trains as soon as the robins began to sing and keep them on until the geese flew south. Recently it has become necessary for the railroads to watch the use of motive power and other equipment very closely. A shortage of coal last year made it incumbent to see that locomotives were used to the fullest extent; while the shortage of motive power required that it be used to the greatest advantage and its use in non-revenue producing service be reduced to a minimum. These necessities are even greater now because of the large volume of traffic the railroads are being called upon to handle.

Just as the use of machinery has increased because of a shortage of labor, other means of carrying men and materials over the railroad will be sought for when it is found that engines are not available for work train service. This is a problem worthy of serious thought to what can be done to reduce the use of work trains.

Large power motor cars with trailers can be used in many cases as a substitute for work trains. Such cars can be used to carry with safety, large gangs of men from camps to points of work. Where surfacing is to be done and ballast has been distributed the transporting of men back and forth is all that a train is needed for and motor cars will readily supplant the train here. So also with all kinds of track work. Not only are motor cars readily used for carrying men, but they can also be used for distributing materials such as angle bars, spikes, rail anchors and ties.

Possibly the most used excuse for a work train has been that there was material to distribute. But regular trains can be used for carrying cars of material from station to station, the material being unloaded and distributed from the station with a motor car. It is not necessary for each section to have a large motor car. One or two large powered cars with trailers on a district can be sent to different points as required.

The motor truck can be utilized to a large extent in lieu of work trains. Instead of getting a train to haul materials around terminals, motor trucks have been hired for a few hours. It is quite possible in this day of highway development that the proximity of highways to railroads will permit carrying materials to highway crossings from stations and then distributing them by motor car. Where coal is to be carried to flag cabins, motor trucks can be used. Also in getting coal to stations it can be hauled from a car placed in the nearest yard, the car being taken from yard to yard or station to station by regular switch runs or trains.

Close co-operation with the operating officials in arranging for the spotting of cars at vantage points with switch engines where available, will often save a work train. This has been done with surprising results by some roadmasters who have large terminals to maintain.

It is not possible to avoid the use of work trains entirely. Sometimes where motor cars, motor truck or switching can be utilized the amount of material to be handled, or the number of times it would have to be hauled in using these facilities may make it more economical to employ a work train. The cost must be considered carefully. Highways may not be so located as to permit the economical use of trucks; the frequency of trains may make it too hazardous to use motor cars with heavy loads, and regular trains may not be able to handle dead head freight or do switching. Having decided that a work train is necessary, its use must be carefully planned.

Too frequently work trains are ordered on the spur of the moment without due thought being given to the amount of work to be done. It does not seem excusable to use a work train to carry a frog, or a few ties, or a few rails a long distance.

The tieing up points for trains should be carefully considered and work planned so that trains can be tied up as soon as possible after the work is done and without making long runs. Possibly a train can be worked out one day and back the next, using regular trains to get men to and from work. Where tieing up points are too far apart, consideration may be given to carrying an extra water tank and a car of coal along, and arranging for a night watchman to care for the engine.

Much extravagance is possible with work trains. Maintenance work is a game of anticipation. The game should be played hard and work planned ahead so as to do it in the most economical and efficient manner. Remember that engines should be used as much as possible for earning money this year and when it is necessary to use work trains, also remember that money saved is money earned.

The Road Train Minimum

By E. R. Lewis

Office Engineer, Michigan Central, Detroit, Mich.

The road train is the logical means of transportation of railroad repair materials and of the employees and tools necessary to the distribution and installation of replacements which constitute railroad maintenance. It is also indispensable in railroad construction. As the product of a railroad is the transportation of freight and passengers, it is natural and often imperative that company materials and company servants on duty, be carried over its own lines, so that the property may be kept in condition suitable for the efficient and continuous service demanded by the public. The conditions under which the repairs are made frequently demand special trains, as a large percentage of the work is remote from stations and sidings.

Prevention of delays to scheduled trains and to road trains operating over the same tracks is a problem which constantly taxes the resources of those in charge of the various movements required. The time necessary to drive a bridge pile or to unload a train of ballast cannot always be foretold to a nicety, nor is the scheduled train for which the track must be cleared always on time. If delay occurs, it is usually the maintenance gang and the road-train that suffer. The relative importance of maintaining tracks and of adhering to train schedules therefore demands close study to get the best results, with so many variables involved.

The problem of the maintenance of way officer is to make the minimum use of road train service compatible with efficiency. There are occasions when men or materials may be transported on regular trains, on way freights or freight extras, by section motor cars, by motor truck over highways, or by street cars or interurban car. Yard and industrial tracks may be used instead of passing tracks. Boarding cars, which must be hauled by road train or freight train, can sometimes be eliminated in favor of camps, especially where the work does not require frequent moves. Temporary sectional camp houses that may be moved readily are finding increasing favor over boarding cars. In addition to increased comfort of employees and reducing the turnover of labor thus housed, the elimination of the expense of fitting and maintaining cars and of providing track room and power to move them, constitute considerable savings and conserve facilities devotable to revenue service.

The object to be attained is such a balance of consideration of the importance of the maintenance program compared with operation of revenue trains, as will assure the greatest ultimate economy to the company. Interference with revenue train service is so obvious a disadvantage and the expense of delaying maintenance work is so remote from operation and so difficult to calculate, that the latter service is apt to suffer unless the entire problem is constantly exposed to the closest scrutiny of far-seeing and experienced officers. The problem is simplified wherever use of road trains may be eliminated economically.

The solution moreover depends primarily on the purchasing of maintenance materials early enough to permit them to be distributed during seasons of slack traffic, when the work may be accomplished with a minimum of interference and when the regular maintenance force is not busy with the summer program.

Moving track materials by motor trucks equipped with cranes, especially in the vicinity of terminals, is a lucrative source of economy. It saves switching, track room and delays in delivery. Moving earth with tractor shovels and motor trucks is a favorite way of dispensing with road train service. There are many long stretches of main track on various railroads that have been reballasted by distributing a few carloads of gravel or crushed stone daily by way freight train, the locomotive being detached long enough to unload the ballast cars.

Conditions peculiar to each case should be weighed carefully before the road train, which is the normal instrument of transport, is dispensed with. Temporary spur tracks installed at locations convenient to the sites of structures where work is required, serve to minimize road train service. Their usefulness is notable at bridge sites, where cranes and pile drivers which may be operated under their own power can be used to move material under load when required. Such spur tracks are often laid to house boarding cars and other special equipment in maintenance use. Turnouts are sometimes not installed for these spurs as it is cheaper if the parent track is secondary, to disconnect it, in order to place cars on the spur and to remove them after the spur has served its useful purpose.

Recovery of bridge materials from beneath replaced structures without the assistance of a road train can be effected with a stationary hoist and cable, supplemented by an inclined monorail or other track contrivance leading to a loading dock at car floor level at the bridge end. The choice of method of maintenance transport is determinable readily enough by officers conversant with the details of all the services concerned.

Trainmen Must Operate Air Dump Cars

The Order of Railway Conductors and the Brotherhood of Railroad Trainmen protested against the action of the Northwestern Pacific in requiring trainmen to operate Lidgerwoods, Jordan spreaders or air dump cars. In drawing up the agreement with its employees the railway agreed to relieve trainmen from the physical operation of Hart convertible and similar types of work cars which are dumped by means of a ratchet operated by a man at the end of the car. Air dump cars require merely the manipulation of a valve located on the end of the car to dump the car and return it to the normal position after dumping.

It has long been the standard practice for trainmen to operate these valves, while maintenance of way employees were assigned to the operation of such cars as required physical effort. The Labor Board decided that the service required was not unduly burdensome and that it was reasonable to expect trainmen to operate the valves on air dump cars.—Decision No. 1326.

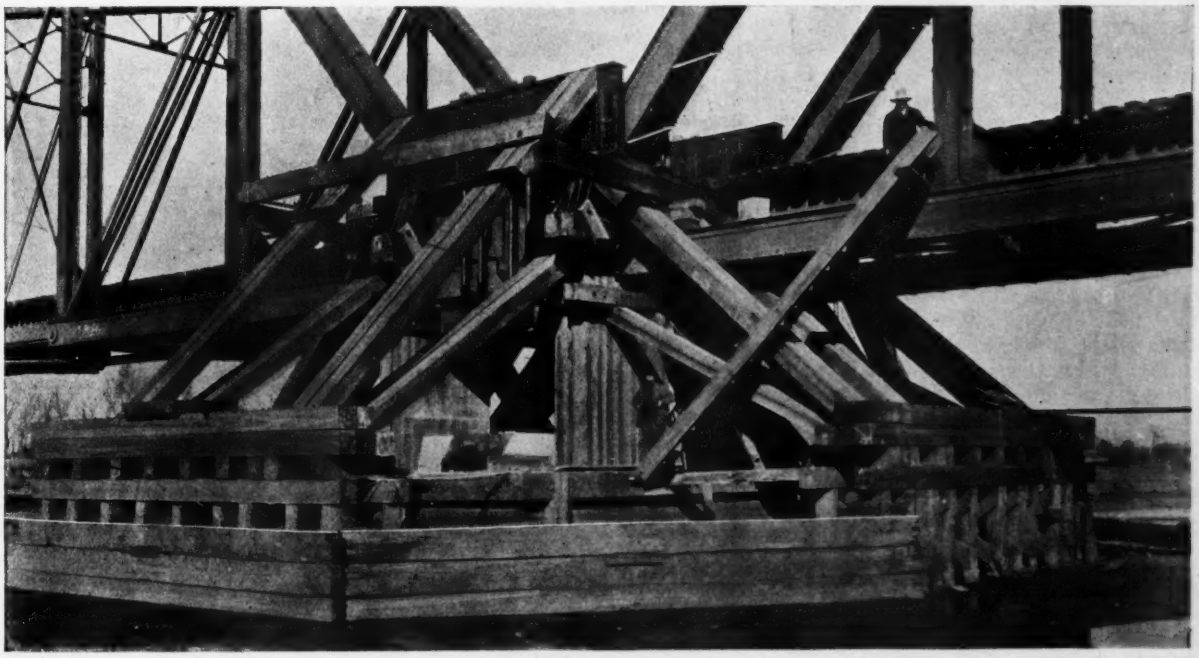
While Normally Carrying Little Water the River is Exceedingly Treacherous During Flood Periods

Special Harness Supports Spans

Substructure of Santa Fe Bridge Overhauled Without the Use of Any Elaborate Falsework

HOW THE shaft of a bridge pier that carried the ends of two 300-ft. truss spans was renewed without placing the spans on falsework is an interesting story that involves the description of an ingenious harness which relieved the pier of the superstructure and live load while the masonry work was in progress. The bridge in question is one of three crossings of the South Canadian river on the Atchison, Topeka & Santa Fe near Purcell, Okla. The pier was built in 1895, and is on a pneumatic foundation carried to rock. The shaft was of Kansas limestone which weathered to such an extent during its 27 years' life that it became necessary to rebuild it. This included the entire removal of the top of the pier to a level several feet below the bridge seat and required a complete jacket of reinforced concrete.

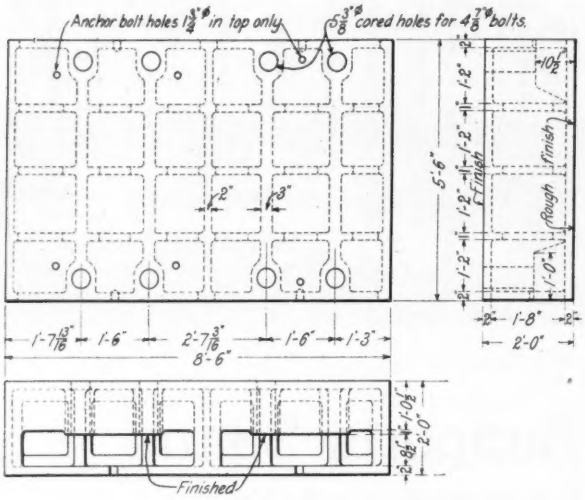
To support the two 300-ft. spans on falsework, while the repairs were in progress, would have been both expensive and dangerous on account of the treacherous nature of the river, which makes it exceedingly difficult to maintain falsework during times of heavy discharge. To avoid complete falsework, A. F. Robinson, bridge engineer of the Santa Fe system, developed a special construction by means of which it was possible to support the



A Close View of the Temporary Construction Around the Pier

ends of the two 300-ft. spans on the top of the pneumatic foundation, where it projected beyond the faces of the pier shaft.

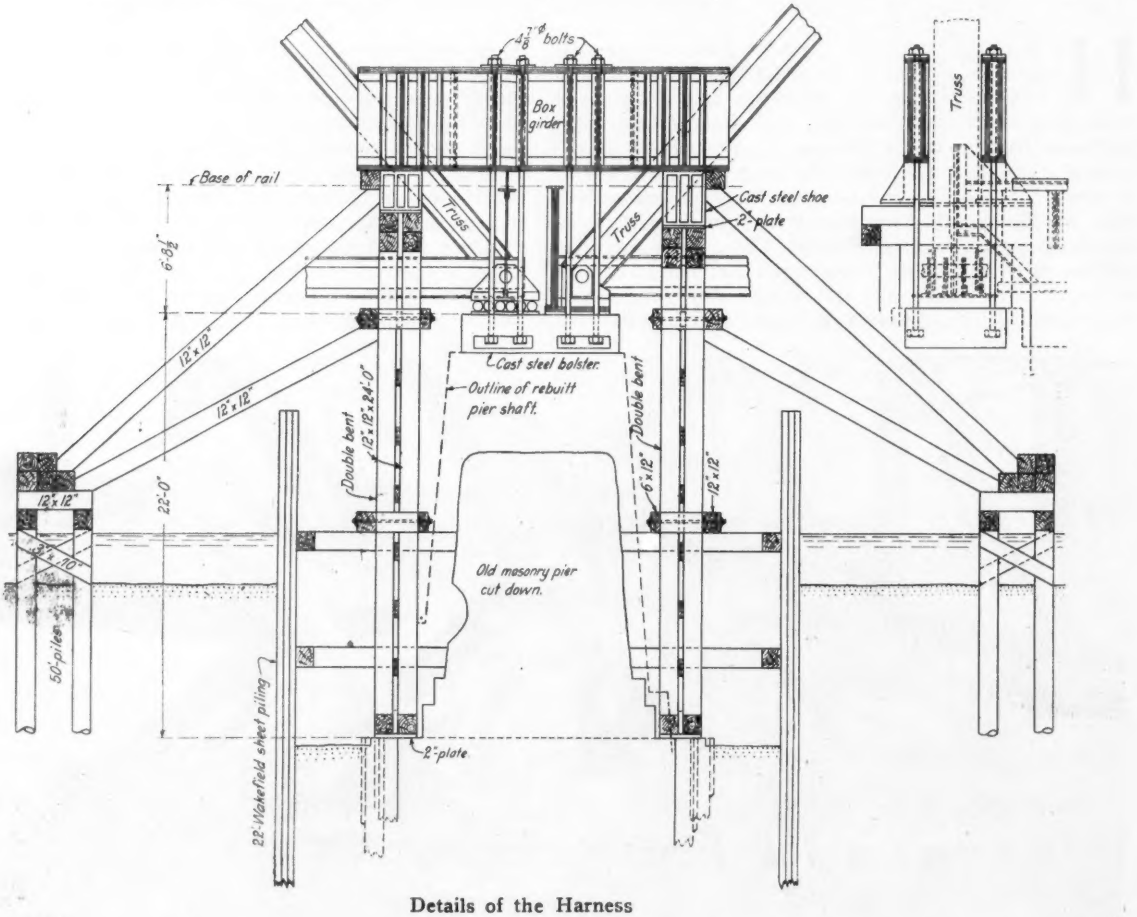
The pier was enclosed by a cofferdam of 22-ft. Wakefield sheet piling, which permitted the unwatering of the pier down to the top of the pneumatic foundation. The concrete in the projections at the top of the foundation beyond the faces of the pier shaft was examined carefully to insure that it was entirely sound and capable of carrying the heavy load to be imposed. On this, steel plates two-inches thick, 14 ft. long and sufficiently wide to carry double bents made of 12-in. by 12-in. material were carefully bedded and doweled in placed. These double bents consisted of two rows of eight 12-in. by 12-in. posts 24 ft. long with sills and caps and were four in number, one each being placed under the corners of the spans; that is, these bents were set on the footing offsets of the piers in such a position that each of them was bisected by the center line of one of the trusses of the two spans, the caps of the bents being divided so that one portion was outside of the truss and the other inside.



Details of the Bolster Casting

On these caps were fitted cast steel shoes, one outside and one inside of the trusses, these shoes acting as supports for box girders 20 ft. long and 5 ft. deep spanning across the top of the pier. Suspended from each of these girders were four hanger rods, each 4⅞ in. in diameter, to serve as the means of supporting large cast steel bolsters that had been substituted for the bearing shoes of the trusses.

The bolster castings were 8 ft. 6 in. by 5 ft. 6 in. by 2 ft., large enough to support the ends of both spans, one being provided under each side of the bridge. Each was provided with 5-in. holes for the eight suspender rods with a pocket at the bottom for inserting the 8-in. by 8-in. square nuts which these long rods required. Similar nuts were provided at the tops of the box girders. These hanger rods passed down inside the box girders between the two webs, a 5-in. hole being provided in the top flange while, for purposes of adjustment, the hole in the bottom flange was slotted three inches.

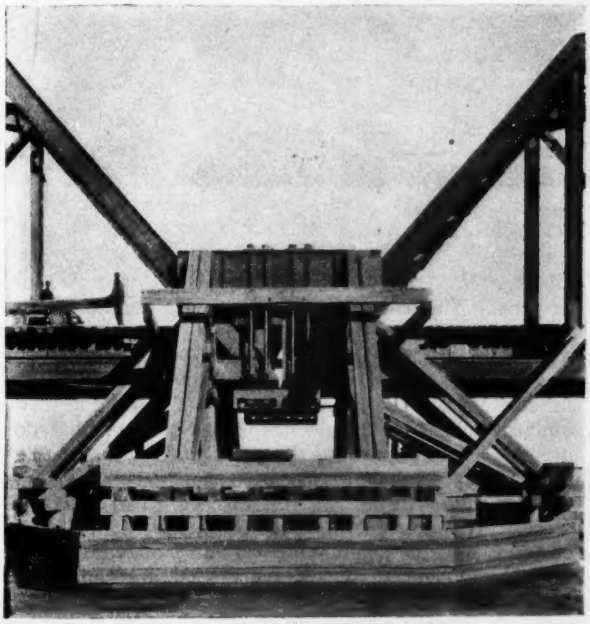


Details of the Harness

The Box Girders as Seen From the Track

Thus, the weight of the spans and the trains passing over the bridge was effectively transmitted from the end bearings of the trusses to the top of the pier foundation on either side of the pier shaft. However, security for the construction involved one other feature, adequate bracing against lateral and longitudinal movement. This was provided by driving double pile bents flanking the pier on all four sides from which inclined timbers could be braced against the bents and girders in an effective manner.

With the bridge span supported by this harness, it was possible to cut away the top of the pier and carry on the repair work without interruption to traffic and without any obstruction in the river bed that would have been dangerous in case of flood. As shown in the photographs, the construction was very compact and offered little interference to the flow of the stream. After the load of the bridge had been transferred to the falsework, a settlement of ⅜ in. occurred under the heavy double-headed trains crossing the bridge, but since then there has been on settlement of the track. The maximum loading crossing this bridge is very nearly equivalent to E-60.



How the Falsework Supported the Truss While the Pier Shaft Was Entirely Removed

We are indebted for the above information to A. F. Robinson, bridge engineer, Atchison, Topeka & Santa Fe System, Chicago.

Cutting Old Bridge Ties Into Paving Blocks

THE ERIE has developed an economical and satisfactory method of utilizing old bridge ties in the construction of heavy traffic street crossings. The ties are sawed into blocks, which are treated in a simple and inexpensive manner and, when laid, have resulted in a crossing surface that gives practically no trouble.

Old 8-in. by 8-in. bridge ties of heart pine or white oak are used for this purpose. By means of a circular cross-cut saw the ties are cut into 6-in. lengths. Only the sound sections are used, the imperfect parts of the ties being discarded as the cuts are made. Other lengths of cut may be made as desired, according to the height of the rail used in the crossing. The wood blocks so formed are thus 8 in. by 8 in. by 6 in. These blocks are soaked for a short period in a vat of either cold creosote or some similar preservative, after which they are allowed to drain. When this is completed they are piled or stacked ready for use.

Before a crossing is installed the track structure is given careful attention. Long rails are used, the customary length being 66 ft. These lengths are laid on tie-plated, creosoted ties, well tamped on rock ballast. The space between the ties is next filled with ballast, after which it is thoroughly tamped and rammed until a hard, well-compacted surface has been secured level with the tops of the ties. In this way, any possible settlement of the paving between ties is fairly well obviated. The flangeways are formed by old rails laid on their side. The creosoted blocks are then laid between the flangeway rails with the 6-in. edges vertical, thus giving an end-grain wearing surface at about the same height as the top of rail. Each end of the crossing is finished off with a 6-in. plank laid straight across and fastened securely to the ties. The crossing is then completely sealed by filling all the spaces and coating the surface with an application of Tarvia.

The experience of the Erie at Jefferson street, Passaic, N. J., where a test crossing of this kind has been installed, has been so satisfactory that this road plans to cut up all of its old bridge ties for this purpose. At this point one-half of a 66-ft. street has been installed with wood block paving and one-half with plank. After practically five years' service under extremely heavy vehicular traffic, the wood block section of the crossing has showed little or no wear and as a result it has been given almost no maintenance. On the other hand, it has been necessary to renew the plank crossing on an average of from 12 to 14 months. When ruts begin to develop and repairs become needed, the blocks will be renewed only at the worn places, thus keeping maintenance costs down

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THE RAILROAD PROBLEM.—President Harding regards the railroad problem as one of the most important now before the country and expects to devote some attention to it in the speeches he will make on his contemplated trip through the country to Alaska.

Recent Train Accidents Due to Roadway Defects

A number of wrecks involving loss of life have occurred recently which have been due to defects in roadway and structures. The following references to three accidents of this character have been abstracted from reports of investigations made by the Interstate Commerce Commission.

Derailment From Slide in Cut

A northbound freight train on the Tennessee division of the Illinois Central was derailed after striking a slide in a cut near Corinth, Miss., on March 17, resulting in the death of two employees and the injury of one employee. The photograph shows the nature of the wreck in spectacular manner. This cut is approximately 4,000 ft. in length and at the point of the accident is about 45 ft. deep, 126 ft. wide at the top and 36 ft. wide at the bottom, with well cleaned surface ditches on each side of the track extending 1.2 ft. below the sub-grade. The fall of the ditch was at the rate of 21 ft. to the mile through this portion of the cut. The drainage on top of the bank on the west side of the cut is diverted away from the cut to a ravine about 50 ft. west, while the drainage on the east side of the cut flows northward to a ravine located near the north end of the cut. The track was ballasted with 18 in. of gravel, which rests on a stratum of blue clay over 8 ft. in depth and which extends 3 ft. above the top of rail in the slopes of the cut, above which is a sandy red soil for 22 ft. covered by 3 ft. of blue clay and 16 ft. of sandy loam at the top.

This cut had been considered a dry cut without any tendency to slide. A train had passed over this track an hour and a half previous to the accident without noting any indications of trouble.

Following the accident an inspection disclosed a crevice in the west end of the cut approximately 10 ft. below the top of the slope and about 10 ft. wide, extending vertically for 35 ft. to the lower stratum of blue clay, the bottom of the crevice being 35 ft. in from the face of the slope. Approximately 7,500 cu. yds. had broken away and slid into the cut, causing an upheaval in the road bed of a maximum of 16 in. There was some evidence that the track had also been pushed out of line.

The precipitation from the first of the year up to March 19, 1922, was 19.80 in., while in 1923 it was only 14.50 in. The precipitation from March 1 to March 19, 1923, inclusive, was less than half that for the corresponding period of the previous year.

Train Derailed Because of Insufficient Ballast

On February 26 a passenger train on the Nashville, Chattanooga & St. Louis was derailed near Calhoun, Ga., resulting in the death of one passenger and one employee and the injury of 24 passengers, one mail clerk and nine employees. The train consisted of 12 steel coaches and sleepers hauled by two engines and was traveling at a speed of about 45 miles per hour at the time of the accident. The derailment occurred on a 3 deg. 46 min. curve, the super-elevation and gage of which were in good condition. The track was laid with 90-lb. rails, tie-plated and double spiked to 18 creosoted ties per panel. The ballast at the point of the derailment was crushed stone.

Photo by Underwood & Underwood.

The Train Buckled in Two Places

In its report, the Bureau of Safety of the Interstate Commerce Commission concluded that the accident was caused by a weakened condition of the track due to insufficient ballast. The evidence indicated that the section foreman had been raising the track and putting in new ties, in doing which it had been necessary to remove much of the old ballast. After this work had been completed, there was not a sufficient amount of ballast in the track, and the combination of thin ballast, new creosoted ties, which are very slippery when wet, and heavy rain, undoubtedly caused the track to slide out of line under the weight of the two engines at high speed, resulting in such a violent motion of the engines as to cause the left rail to overturn and derail the train.

The report states further that while the responsibility rests primarily with the section foreman, the condition of the track in this vicinity was or should have been known to supervising officials in the track department and they are open to censure for their failure to see that proper steps were taken to make the track safe for the movement of heavy trains at high speed, or else that proper warning signals were displayed and restrictions imposed requiring trains to proceed at low speed until they had passed over the section of insecure track.

Train Strikes Bridge Burn-Out

A passenger train on the Madison (Wis.)-Portage line of the Chicago, Milwaukee & St. Paul was derailed by running into a bridge burn-out near Poynette, Wis., early Monday morning, March 26, resulting in the death of 3 employees and the injury of 12 passengers, one express messenger and one employee. This bridge was a three-bent wooden structure, 48 ft. long, constructed of cedar piling and fir timbers. The deck was covered, for fire protection, with galvanized sheet iron, but in order to avoid interference with a track circuit for the operation of crossing warning bells a strip of this covering about four inches wide was cut out along the inside of the south rail for the entire length of the bridge. The deck of the bridge was about 8 ft. above the stream bed at the highest point. This bridge was located on a 3 deg. 30 min. curve. The ground was covered with snow around it and under the bridge at the time of the accident.

No regular patrol was maintained on that section of track. A freight train had passed over the structure on the afternoon of the preceding day and the grates on the engine were shaken considerably on the ascending grade in the vicinity of the bridge, the coal being of poor quality. Owing to the fact that the previous day had been very windy it was thought that the fire, which had completely destroyed the structure, had originated from live coals dropped by the engine of this train.

The Maintenance of Switches*

By G. W. LAMB
Extra Gang Foreman, Kansas City Southern, Shreveport, La.

THE maintenance of switches is an important detail of maintenance of way work. Foremen passing over switches when going to work should throw them, and see that the points fit tight against both rails. They should also try the gage on all switches and turnouts at least twice a week, and see that it does not vary from the standard.

Switch points on main line switches should never be allowed to become blunt or worn to any great extent, but they should be replaced with new ones, and the old points used in inside tracks where the traffic is slower, and lower standards of maintenance are permissible.

In changing out switch points, a new stock rail should also be installed, for if a new point is put in beside the old stock rail, it will soon wear down, and become as bad as the one changed out. A good bend should always be put in a stock rail the proper distance ahead of the point; and the rail should be bent to match the planed side of the switch point, as it requires a greater bend for a 12-ft. point than it does for a 15-ft. point.

Heel fillers and heel plates should always be used at the heel of a point. The heel bolts should be put in from the outside of the stock rail, as it is much easier to take off the nuts and angle bars from the inside of the point and slip the point out. In this way it is not necessary to remove the bolts, which is of advantage as this is apt to damage them so they will have to be rethreaded to use again. The work is also done much easier this way. Often the heel of the switch point becomes lower than the stock rail and allows the wheels to strike the side of the stock rail before it comes to the mounting point; this is a dangerous condition, and to overcome it, it is necessary to remove the slide plates and heel plates and adze the ties level; if the heel plates have become thin on one end, they should be turned around and the thick end placed under the rail that has the most friction. In this way the point can be brought up to the level of the stock rail at small cost.

Connecting rods are often the cause of switch points becoming blunt. In many of our switches there is from ⅛ in. to ½ in. slack in the connecting rod and the head rods, which is usually taken up by the use of a bushing of some kind; often this bushing slips out and allows the point to open to the thickness of the bushing, the wheel then begins to strike the end of the point, and it soon becomes blunt and unsafe. To overcome this, remove the connecting rod from the switch, heat the end, and strike it directly on the end with a maul; this will close the hole to the size required to fit the head rod, and it will serve the same as a new rod.

Turnout frogs should be watched very closely, and an even bearing maintained on the ties. Frog plates should be used under all rigid frogs, and bolts in frogs should be kept as tight as possible to prevent the fillers from working and becoming loose. In changing out frogs, where the rail heads at the toe and heel of the frog are worn down, the rails on each side of the frog should be changed out to make a good joint at each end of the frog. Frogs are much more expensive than rails, and it is very hard to maintain their surface unless the joints are in good condition. Guard rails require more attention than frogs; they should be placed in their proper place with the center of the guard rail 12 in. ahead of the frog point, with end fillers, division blocks, clamps and wedges adjusted to the proper width, which is 1⅞ in. from the running rail. The wedges in the clamps should be placed on the outside of the track to prevent brake rigging, etc., from striking them and throwing them out of place.

Guard rail plates should always be used, with the shoulder of the plate inside of the guard rail, as the plate will hold the guard rail in place much better this way. On leads in yard tracks it is best to place two or three rail braces inside of the guard rail in addition to the clamp, as the heavy traffic will soon knock the guard rail out of place without them.

Yard switches should be watched the same as main line switches, but in many cases material can be used in yards that would not be safe for main lines, owing to the lower speeds in yards. Yard lead switches should be watched very closely and kept cleaned and oiled. Switchmen, in kicking cars, will often fail to get a switch closed ahead of the wheels on account of dirt and lack of oil on slide plates. This often causes derailments and

*Abstracted from a paper presented before the Kansas City Southern Maintenance of Way Association at Shreveport, La., on Feb. 10.

damages the switch to an extent that heavy repairs are required, causing unnecessary expense.

Switch ties in all switches should be renewed as often as necessary. On lead switches ties often become weak from frequent gaging, yet the tie is solid enough to carry the load, and the application of a few rail braces will prolong the life of these ties a year or more. In renewing switch ties in leads where more than half the ties come out, and the balance are badly rail cut, it is best to remove the entire set, turning the sound ones over, and placing them back in the place, while renew the ones not fit for further service. In this way the surface will be smooth and all ties will carry their proper load.

In relaying switches or relaying rail in yards, the joints should be oiled behind the new work, and the bolts tightened often until they are well set; owing to the heavy traffic new joints will soon become loose and in a short time they are in the same condition as before.

Foremen should select material suitable for the switches they are repairing, using the best material for the switches with the heaviest traffic. The other tracks can usually be repaired with second-hand material.

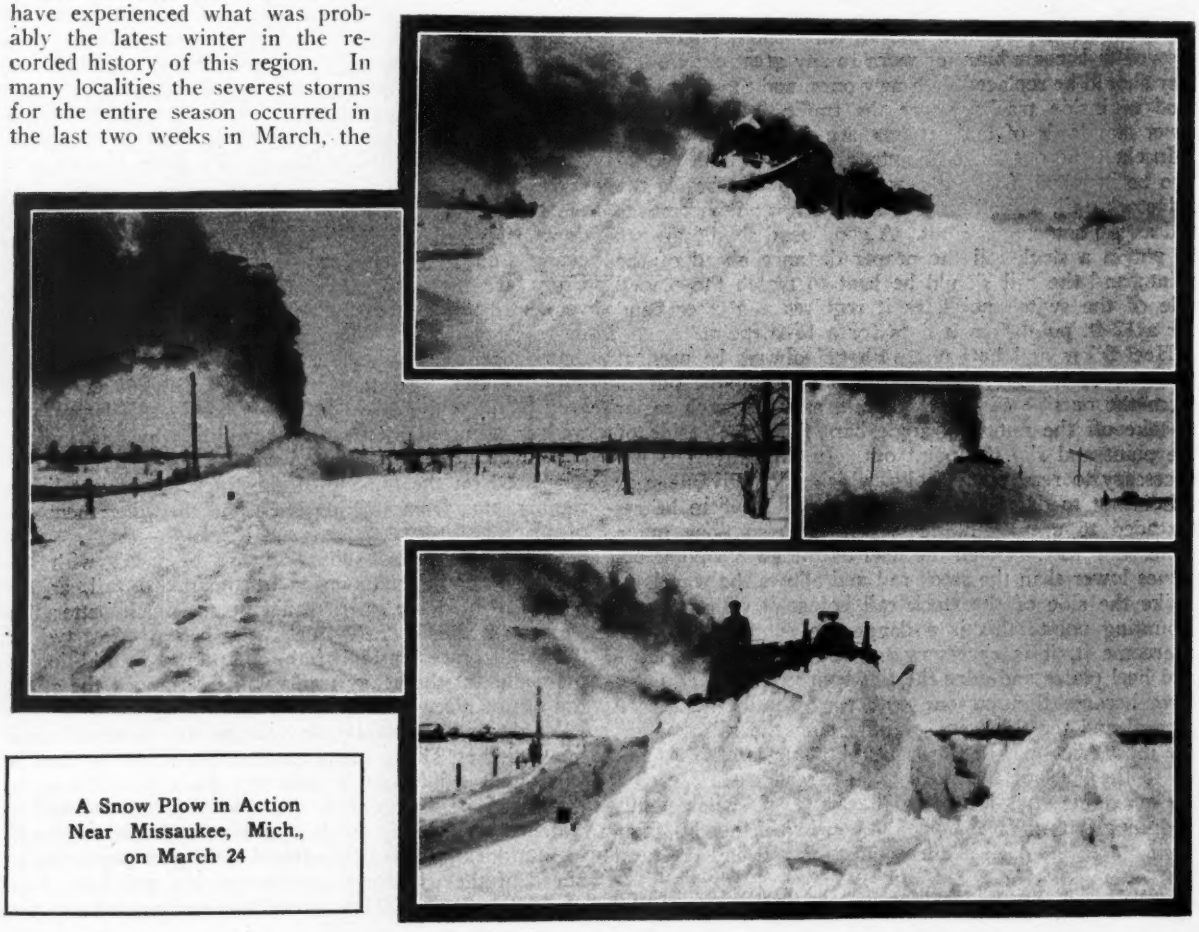
Spring Blizzards Tie Up Railroads in Michigan

ANY reference to snow storms would be entirely out of place in the May issue of any periodical were it not for the fact that it is only within the last week or two that the rigors of winter are beginning to subside in the north central states which have experienced what was probably the latest winter in the recorded history of this region. In many localities the severest storms for the entire season occurred in the last two weeks in March, the effects of which extended well into the month of April.

Probably the severest effects of these late storms were experienced by the Pennsylvania's line to Mackinac City, Mich. Although snow troubles were had in plenty on this line for a large part of the winter, requiring snow plow operation for 50 days in three months, the worst storm occurred late in March, as evidenced by the photographs which were taken on March 24. The storm belt extended from Big Rapids, Mich. to Mackinac and at the end of the first week in April there was still five feet of snow in the woods, making it necessary to suspend logging operations, while on April 7, a fresh storm brought an additional fall of eight inches followed by a drop in temperature that filled the track with ice.

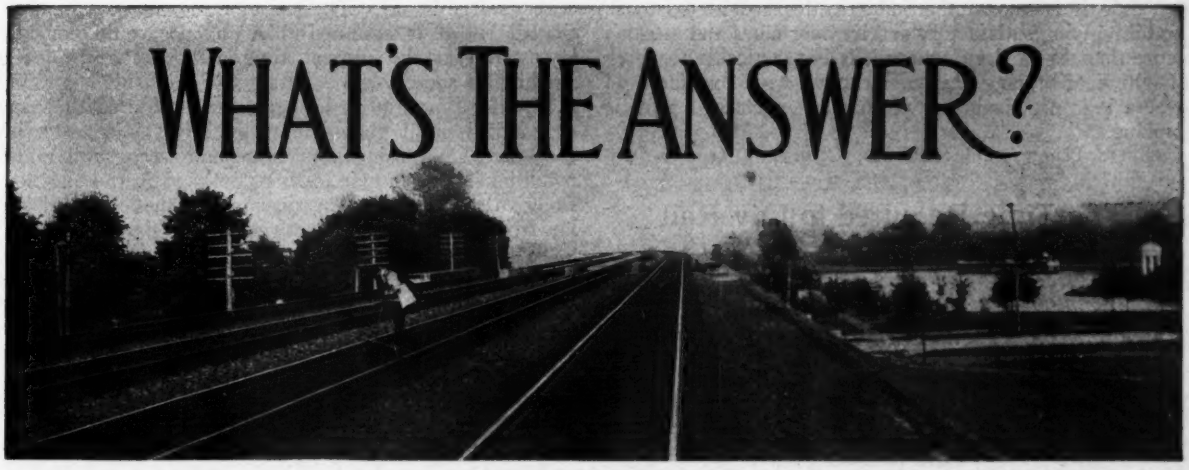
This experience was typical of a considerable portion of the snow troubles of March, the lateness of the season resulting in alternate thaws and freezes which had the effect of freezing the slush in the tracks and making the operation of snow plows extremely difficult. Another feature of the storms was a prevalence of easterly winds of high velocity, which prevailed for a large part of the time and caused excessive drifting especially in the case of the Pennsylvania's line which traverses the country in a north and south direction. Another reason for difficulty from this source is ascribed to the absence of natural barriers in the form of forests.

Under such circumstances, there were a number of serious interruptions to transportation even as late as April 7 when a freight train was stalled for 18 hours about 60 miles south of Mackinac. We are indebted to E. L. Hoopes, division engineer, Pennsylvania System, at Grand Rapids, Mich., for the photographs.



A Snow Plow in Action Near Missaukee, Mich., on March 24

WHAT'S THE ANSWER?



This department is an open forum for the discussion of practical problems of engineering and maintenance of way. Readers are invited to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. *Railway Engineering and Maintenance* also invites the co-operation of its readers in answering any of the questions listed below.

Answers to the following questions will be published in the July issue:

(1) What is the sharpest curve that may safely be made when laying bell and spigot pipe of different sizes?

(2) How can abandoned tracks, as, for instance, three or four miles of ballast pit tracks, be taken up most economically?

(3) What are the signs of over-stress in a steel bridge that may be most readily detected by inspection?

(4) To what extent is it practical to introduce colors in poured concrete or portland cement stucco? How is this color introduced into the concrete?

(5) What are the relative merits of long and short guard rails opposite frogs?

(6) Where the mixing of chemicals and untreated water is accomplished by mechanical agitation, what is the most efficient speed of operation?

(7) Is the dropping of concrete from considerable heights objectionable, and, if so, what is the practical limit?

(8) How often should screens be painted and what is the best kind of brush to use?

Sway Bracing Piles

How high above the ground may piles project without requiring longitudinal sway bracing?

First Answer

When standard size piling is used with, say 8 in. to 10 in. tips and 15 in. to 16 in butts, spaced five or six piles to the bent with a minimum penetration of not less than 12 ft., they will hold steady and give good service with simple "X" or sway bracing, using 4 in. by 10 in. plank, up to an approximate height of 21 ft. from the ground.

Pile bents 22 to 36 ft. from ground to top of cap should be sash and longitudinally braced. Local conditions sometimes arise when the pentration of pile bents is limited to three or four feet or less, and in some cases pile bents should be sash and longitudinally braced near the ground line.

J. J. TAYLOR,
Superintendent Bridges & Buildings, Kansas City Southern, Texarkana, Texas.

Second Answer

I do not think that this is a question which can be categorically answered. At least it would not be approached in that manner from a construction standpoint. Each trestle must be taken as an individual case and studied accordingly. If there is nothing to prevent doing so, it would seem that all trestles with piles projecting 20 ft. or more above the ground should have longitudinal bracing. This, however, is not always practicable, because of drift carried by the stream crossed or for other reasons.

Some of the features which should be given consideration in determining whether longitudinal bracing should be applied are the fluctuation of the water surface where the trestle is across a stream, the location of the structure with reference to stations, passing tracks, railroad crossings, or other points, where it is necessary to apply the brakes; and also its location with reference to momentum grades. The length of the trestle should also be taken into consideration, as a short trestle obviously, does not require the same bracing against longitudinal thrust as one of greater length.

J. W. WILLIAMS,
Chief Engineer, Western Pacific, San Francisco, Cal.

Third Answer

Assuming that the question applies to a trestle on main line carrying modern heavy locomotives and rolling stock moving at high speed, the answer will be found in the year's report of the Committee on Plans for Wooden Trestles, of the American Railway Engineering Association. This report specifies where longitudinal bracing should be used as follows:

"Trestles which are 100-ft. or more in length and over 15-ft. in height from the base of rail to the ground shall have longitudinal cross bracing every second or third panel. Longitudinal girts must be carried to the bank, and securely fastened to the bent near the ground line."

While it is known that pile trestles are in existence and are giving satisfactory service over lakes and streams more than 15-ft. deep, where it is impracticable to apply longitudinal bracing, this construction would not be used where it is practicable at reasonable expense to provide bracing.

J. B. MADDOCK,
Engineer Bridges and Buildings, Central of Georgia, Savannah, Ga.

The Time Required to Lay Rail

How many track feet of rail should be laid per man per day (of 8 hours) with a gang of 70 men relaying 80 lb. rail with 90 lb on a single track with six trains a day during working hours, the work to include changing the tie plates, adzing the ties and full bolting and spiking, the rail and other materials being distributed ahead of the rail gang and the old material being uncoupled and loaded by other forces?

First Answer

A gang of 70 men laying steel as outlined above, should lay four rails per man per day or 66 track ft. per man if properly organized with the work arranged so that no time will be lost in closing up for the trains; if a rail laying machine is used.

A. L. CAMPBELL,
Steel Gang Foreman, Southern Pacific, Sacramento, Cal.

Second Answer

Under following conditions and with the following organization, 9240 lineal ft. of steel or 66 track ft. of rails per man can be laid in an 8 hour day:

(1) Authority to hold freights not longer than 10 min., and slow order of 15 miles per hour on passengers.

(2) 62 men relaying rails on one side of the track, the remaining 8 men following up on other side of track, pulling spikes, on alternate ties and on tangents one out of every three ties on the inside of the rail on curves.

(3) From 6½ to 7 hours expended in laying all the new rails, the spike pullers, the men engaged in throwing out the old rails, the adzers, and tongs men doing the full spiking, and bolting.

The gang is organized as follows:

12 men pulling spikes.
3 " throwing out old rail
1 " putting in tie plugs.
16 " adzing.
12 " rail tongs.
1 " hanging angle bars.
1 " distributing material.
6 " spikers.
4 " bolters.
1 " picking up tools.
2 " putting on rail anchors.
2 " flags.
1 " waterboy.

The number of spike pullers and adz men given is larger than it ought to be, but for various reasons it has been found impossible to get along with a smaller number.

W. R. MAYNE,
Section Foreman, Canadian Pacific, Thompson, B. C.

Third Answer

One difficulty in determining a fair measure of a day's work is the many and varied conditions under which the work is performed. This varies, of course, with the different railroads, but it also varies very largely on the same road and at different times even on the same roadmaster's territory. For instance, in the question for discussion, the six trains a day mentioned might run in such a way that they would interfere very little, with the operation of the rail laying gang, while on the other hand, they might come along at such times as to interfere seriously. The question as to the amount of adzing required is also a very variable one. The use of a machine is not mentioned, but it is assumed that no one would consider laying rail at the present time without the use of a machine of some sort.

About 50 men in a steel gang is considered the most economical sized gang for general rail laying. With a 50-man gang using a machine and laying rail under conditions quite similar to those outlined in the question, except that the rail gang disconnects the old steel, we lay from 2 to 2½ miles per week, which is equivalent to 35 to 44 ft. per man per day. There are times, of course, when better progress is made but there are other times when the gang does not do so well. There are also times, of course, when the gang is not up to the full 50-man strength although everything possible is done to keep it filled up to this number. Taking all these things into consideration we consider the average output mentioned above a reasonable one.

With this as a basis, a gang of 70 men using a machine and laying rail under the same conditions, and not disconnecting the old steel, should average 40 to 50 ft. per man per day.

H. R. CLARK,
Engineer Mainttenance of Way, Chicago, Burlingtton & Quincy, Lincoln, Neb.

Fourth Answer

Working under slow orders, a gang of 70 men should relay 84 ft. of rail, or 42 ft. per man per eight hour day, figuring on closing up four times for trains during the rail laying period. If not required to close up this number of times the amount of rail laying can be increased accordingly, the following organization of men being used:

2 flagmen, the lead flagman hanging joints on the new rail, the rear flagman cleaning up old spikes and tie plates and piling them every half-rail length.
10 men pulling spikes.
2 " throwing old rail out with bars.
1 " removing tie plates with special pointed pick.
2 " setting tie plugs.
1 " driving plugs with a plug ram.
20 " adzing.
1 " cleaning ballast and rubbish from the tie behind the adzers.
2 " placing new plates.
12 " setting rail in track.
2 " placing shims and wrenching one bolt.
5 " wrenching.
8 " spiking every third tie.
1 " with light push car keeping tools with gang and removing shims.
1 " carrying water.

The number of men pulling spikes and adzing may be changed according to local conditions. After sufficient rail has been laid for the day's work, it is assumed that the gang will start back, full spiking as they go, with sufficient men engaged in distributing material ahead for next day's work, also blocking inside of the ties.

A. W. WEHNER,
Roadmaster, Southern Pacific, Louisiana Lines, Lake Charles, La.

Wiring Frame Buildings For Electric Service

To what extent can a frame building be wired for electric service with improved conduit protection without exposing the conduit?

A frame building can always be wired for electric service with improved conduit protection without exposing the conduit. This may be done either be tearing up the floor boards or laying the conduit above each ceiling and "fishing" the conduit between the walls, or altogether by the "fishing" process. The question is only one of cost, the

cost of concealing conduit being about 50 per cent more than the exposed. In one story buildings having an attic, the work is simple, and, of course, much less expensive than in a multiple story building with plaster walls. Ordinarily, however, it is not customery to conceal the conduit when re-wiring the frame buildings, although the same material is usually used for the exposed as for the concealed work. In present day practice this is usually a flexible conduit consisting both of the wires and the conduit, which is much handier and safer than the now obsolete open wire and cleat work, and at the same time less unsightly. In all cases where it is desired to conceal the conduit it can be done without increasing the fire hazard in any way.

Back Filling With Water

Is it good practice to use water in back filling around foundations, etc?

First Answer

It is considered good practice to use water in back filling around foundations in almost every instance where it is known that the foundations are on a satisfactory bottom. This use of water or puddling tends to compact the fill so that if done carefully, there is practically no settlement after the job is completed.

A. L. GAUTHIER,
Supervisor Bridges and Buildings, Boston & Maine, Concord, N. H.

Second Answer

Water is one of the best tampers. The back filling around all exterior foundations and in trenches is exposed to rain water which will eventually saturate the newly filled earth and cause it to settle, no matter how thoroughly the dry tamping is done. For this reason it is better practice to keep the dirt wet as it is being filled in.

In the case of machine foundations and trenches for interior pipe lines and conduits, built after the roof has been put on, if the back filling is deposited dry in thin layers and each layer thoroughly tamped it will usually be satisfactory.

L. H. HARPER,
Superintendent, Creosote Plant, Central of Georgia, Crump's Park, Ga.

Pump Slippage Defined

What is the meaning of the expression "slip" as applied to pumps and what are its principal causes?

It seems that the expression slip or slippage as applied to pumps originated from the slipping which characterized the action of pistons of displacement pumps, the pistons or plungers failing to pick up the load until it had advanced some distance on the forward stroke. At the present time the word slip or slippage usually carries a broader meaning. It means rather the percentage difference between the theoretical displacement of the pump and the actual displacement or the loss in hydraulic efficiency. Thus if the discharge from a pump is only 90 per cent of the theortical capacity the slippage is said to be 10 per cent. In this sense the expression is applied regularly not only to displacement but to all classes of pumps.

The slippage arises from several causes and may vary considerably from time to time for the same pump. The principal causes are leakage of packing, allowing water to squirt out or air to gain entrance into the pump chamber; the failure of pump valves to respond properly, particularly in closing and the presence of air in the water, as where the water is hot or obtained from an air lift system. It also arises very often from the fault of operating a pump too fast to allow or permit the incoming water to fill the pump chamber before the beginning of the discharged stroke, or when the practical lift on the suction line is exceeded. By proper adjustment the slippage on a displacement pump can usually be kept within 5 per cent.

The Power Required For Centrifugal Pumps

Is the common make and break type of gasoline engines suitable to drive a centrifugal pump and if so how is one to determine the size engine to use?

The make and break type engine is suitable for operating a centrifugal pump. The usual and the proper procedure in determining what size engine to use is first to select that size and type of centrifugal pump which will meet the established requirements for pumping and then to select an engine to meet the horse power and speed requirements of the pump, it being remembered that the speed at which a centrifugal pump is operated is a controlling factor. Knowing the requirements, the proper size of pump and engine is readily obtained from tables furnished by the manufacturers of the equipment.

Where the question is one of determining whether a certain make and break engine already in service will oprate a centrifugal type pump, also on hand, the characteristics of which are not known, about the only thing to do, in the absence of advice from the manufacturer of the pump, is to try out the combination, always making a belt connection rather a direct connection in the knowledge that a centrifugal pump must be operated at a much higher speed than the engine and also to provide the means of making such adjustments in the speed as trial of the pump will show are required. If it is found that, in starting, the pump races instead of discharging water, it is an indcation that the power is more than enough to operate the unit and that the speed is too high, whereupon an adjustment may be made by altering the size of the pulleys on the engine or pump to produce a lower speed. If on the other hand the engine shows overloading when operating the pump the condition may usually be adjusted by installing a gate valve in the discharge line from the pump and throttling the flow. This will have the effect of increasing the head on the pump. The throttling should not be done on the suction side of the pump as this will usually operate only to increase the tendency of the pump to race. By repeated trials and adjustments a condition can usually be established under which the pumping engine will perform its function without difficulty, although the combination may not be an efficient one.

It is also important when operating a centrifugal pump that all leakage of air into the pump should be avoided and that the precaution be taken against allowing the collection of air in the top of the pump chamber. This may be prevented by tapping the chamber at the highest point and providing for the discharge of any air which collects there, priming alone not being sufficient to overcome this trouble.

Distributing the Load on Bridge Seats

What are the relative merits of sheet lead, iron rust and cement grout to distribute the bearing load on bridge seats?

First Answer

It has been our practice to use dry cement to give a smooth and level bridge seat for bridges. Where there is any decided irregularity in the bridge seats, they are

bush hammered to take out the large irregularities, and where the irregularities are such that bush hammering affects the level of the bridge seat, we resort to grout or mortar. This is the procedure in setting the shoes for new bridges. Where the bearings under old bridges are getting out of surface, due to defective stone, iron rust filling has been resorted to as this can be worked in under the bearing and maintenance men are familiar with the procedure for making up the mixture and working it into place.

No occasion has arisen to use sheet lead. Where the bridge seat consists of concrete, and where reasonably good surface has been secured, ordinarily dry cement is all that is required to put the bridge seat in shape for the bearing.

O. F. DALSTROM,
Engineer of Bridges, Chicago & North Western, Chicago.

Second Answer

In several cases where sheet lead was used I have seen the ends of the bed plates bent up on each side of the girder, the bends starting either from the ends of the stiffener angles or the center of the web. Where cast iron or cast steel bed plates were used they would invariably break somewhere near the center in line with the center line of web. Sometimes the casting will break around the edges.

Recently my attention was called to several broken rib castings where sheet lead was used to transmit the bearing loads. The bridge consists or three 75-ft. through plate girder spans resting on rocker bearings. The lower casting is 2 ft. 6-in square and 6½ in. high with ribs 1½ in. thick. The casting broke near the center rib and the lead when put in was ¼ in. thick. The lead was squeezed out on each side of the casting, varying from 2 to 3 in. It was found that the lead had started to squeeze out under all castings and instructions were issued in this case to replace all lead bearings with cement grout.

This condition it seems was caused by the reaction through the web and stiffener angles. The deflection of the girder will also cause a large part of the load to come on the inner edge of the bearing plates.

I do not know of any case where cement grout has had to be replaced unless conditions have warranted certain changes, or in cases of poor workmanship or overloading. In comparing the compressive strength of the two materials it is readily seen that the cement grout has the greater bearing power. The allowable compression strength of sheet lead is specified at about 250 lb. per sq. in. and cement grout 650 lb. per sq. in.

There is economy in the design of pedestals using cement grout as the area of the bearing surface need not be as great as that required for sheet lead to distribute the bearing loads.

F. H. CRAMER,
Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago.

Third Answer

Sheet lead, say ⅛ in. to ¼ in. in thickness, is useful for bearings on unfinished or rough-cut plane surfaces. The pressure causes the lead to flow into the small voids, thereby affording a uniform bearing. The elastic limit in compression of lead is approximately 1100 lbs. per sq. in. Consequently, continued application of loads above this pressure will produce a progressive deformation, or flattening out, of the lead sheet. The writer has observed many such cases where the original thickness of lead sheets was reduced fully 50 per cent. Flowage of the lead, too, was probably augmented somewhat by the back and forth movement of the girder ends due to temperature changes. This was where sheet lead was interposed between flat steel bolster plates and the unfinished top of cast bolsters for girder end-bearings. Sheet lead is often used, also to good advantage, between semi-finished bottoms of castings and concrete or stone masonry bridge seats. In a bush-hammered stone seat, perhaps not more than half of the casting is actually in contact with the stones. Sheet lead used here fills the interstices and produces a more uniform bearing on the casting.

Iron rust-cement joints appear to be losing popularity. Such joints were used for many years to afford a bearing of metal upon masonry. The writer sees no particular objection to their use, if properly mixed, placed and tamped. However, this type of joint lacks the ductility of lead joints. However present specifications allow these, as an alternative.

Cement grout is now quite commonly used between metal castings and masonry bridge seats. The fineness of the cement, sand and water particles of the grout should adequately take up any unevenness and if given proper time for setting, before taking maximum loads, should prove satisfactory as a bearing material. The bearing pressure should not exceed 600 lb. per sq. in. Cement mortar joints under stone seats, after about 20 years service, were found by the writer to be exceedingly hard and flint-like, when the seat stones were removed when cutting down the masonry for lower bearings of new steel spans.

H. A. GERST,
Assistant Bridge Engineer, Great Northern, St. Paul, Minn.

Jacking Up Track to Remove Ties

Is it good practice to jack up the track in preference to digging out the ties in making tie renewals?

First Answer

Whether it is better to jack up track or dig out in making tie renewals depends on the class of ballast, the condition of surface and line, and number of ties to be renewed per rail. On track where tie renewals are heavy, which in most cases causes irregular surface, it is more economical to jack up the track in preference to digging them out.

On ballasted track where the renewals run three or four scattering ties to the rail, they should be dug out.

On earth surfaced track the ties should always be renewed by jacking up the track as there is no danger of humping the track if proper precautions are taken.

A. W. WEHNER,
Roadmaster, Southern Pacific, Louisiana Lines, Lake Charles, La.

Second Answer

It is not good practice to jack up ballasted track to renew ties. I have seen high speed ballasted track in good surface, line, etc., put in such condition on account of jacking up the track in tie renewals as to require resurfacing. If one has from three to five ties per rail to renew, and the ballast is to some extent picked away from the edges and ends of ties, the track can sometimes be raised from ½ to ¾ in. without causing any damage to the track surface; but if any tie should not be of uniform thickness or if loose stone should begin to roll underneath the tie it would prevent it from being removed. The first thing that is done then is to raise the jack another notch, and if the tie is not then free, the track is lifted again before the tie is finally removed. The result is that ballast will roll under the ties, forming a bad surface, and resulting in surface-bent rail and rough riding track.

After the ties have been inserted in this manner, it is necessary to go over the track and give it a resurfacing,

which could have been avoided if the jacking had not been done.

Dirt track can be raised in tie renewals if care is exercised by the foreman, but where one foreman is very careful and particular in lifting track to remove ties others are not careful with the result that railroads pay dearly for allowing the practice. W. F. MUFF,
Roadmaster, Atchison, Topeka & Santa Fe., Newton, Kan.

Third Answer

It is good practice to jack up the track to remove ties only in gravel or dirt ballast where the track is in poor surface and heavy tie renewals are being made. Under these conditions spikes should be pulled on the ties to be removed, the track jacked up, old ties removed and new ones put in and spiked without being tamped. The track should then be given a general surface and all ties tamped.

Where track is in good surface and a light tie removal is being made it does not pay to destroy the surface by using jacks to install ties. The old ties should be dug out, and the new ones tamped well before installing tie plates.

The track should never be jacked up when removing ties in rock ballast, as the rock will roll under ties and hump the track. A. L. CAMPBELL,
Steel Gang Foreman, Southern Pacific, Sacramento, Cal.

Fourth Answer

It is not a good practice to jack up track to make tie renewals, no matter if the track is only lifted ½ in. to 1 in. a hump is left in the track wherever the lifting has been done because some gravel or ballast always works its way underneath the ties next to the ones being removed. Also if the jacks are not placed straight the track is thrown out of line. Two or three times as much work is then required to remove these humps and reline the track without getting as good a riding track as before, because of the disturbed condition of the roadbed.

Digging out the ties disturbs the roadbed only at the place where the ties are renewed. Of course, if there is a place where the track is out of surface or where reballasting must be done it is proper to raise the track, first pulling the spikes in all ties to be renewed.

THOR MONRAD,
Section Foreman, Northern Pacific, Dickinson, N. D.

Fifth Answer

The track jack should not be used in natural gravel or dirt track, as there is an inducement to keep raising the track higher. Eventually this will produce rough surface, poor line and wide gage. The foot of the jack will force dirt or gravel under at least two ties, no matter what the condition of the roadbed is. If the ballast is dry gravel, the fine particles of sand will run into the cavity under the tie and eventually require the surfacing of the track out of face.

By using the jack on dirt dressed track, the track is not only made rough, but the surface is cracked and broken up. This produces fissures in the roadbed which will drain the water from heavy rains into the cavities under the ties, producing soft and dangerous track. Also where rail does not have the proper expansion, it is dangerous to use the jack in hot weather, as the track is liable to jump out of line. F. M. COLEMAN,
Section Foreman, Chicago & North Western, Inman, Neb.

Sixth Answer

Jacks are used more extensively for the renewal work than is generally supposed, often where they should not be, while at other localities where physical conditions are quite favorable for the use of jacks the more difficult method of digging is resorted to.

No advantage is gained by jacking track ballasted with dead sand, even during the wet season, as it is found that this material does not support the foot of jacks. This forces the sand under the two adjoining ties when lifted, causing irregular surface.

On mud track, cinders, or most bank gravel, old ties can be removed by the use of the jack, provided reasonable care is exercised. I have had a few foremen even make headway by careful jacking in stone ballasted track by digging away the ballast on one side of the ties lightly and scalping off the deadwood on the tops of the ties. Foremen accustomed to handling soft track during the winter months in the southern states, where conditions require them to practice "drifting" or "blow tamping" quickly become expert at jacking out ties without doing damage to the surface.

Blanket instructions cannot be issued for such work, however. New men must be trained by a competent man, such as by doubling up section gangs until each foreman can handle his individual job alone. Some men pick up such work quickly while others merely cause extra work later on by leaving a rough surface.

Where ballast conditions will permit jacking, there is less tendency to pulling ties in pairs or small bunches than when ties are dug out. Also while slight irregularities in the surface may be detected after the day's work is done, conditions should gradually improve daily, while if ties are dug out, the track though it appears satisfactory at the time, often becomes rougher each day.

New ties should never be placed while the rails are on the jacks, except where it is desired to place them in bunches of three or more, when the middle tie should be pulled out first, the bed prepared, and the new tie placed before the old ties on either side are removed. This allows the middle tie to be placed at the proper level by adjusting its top level to the adjoining old ties whereupon it can be used as a guide for placing the balance of the new ties after the rails are dropped.

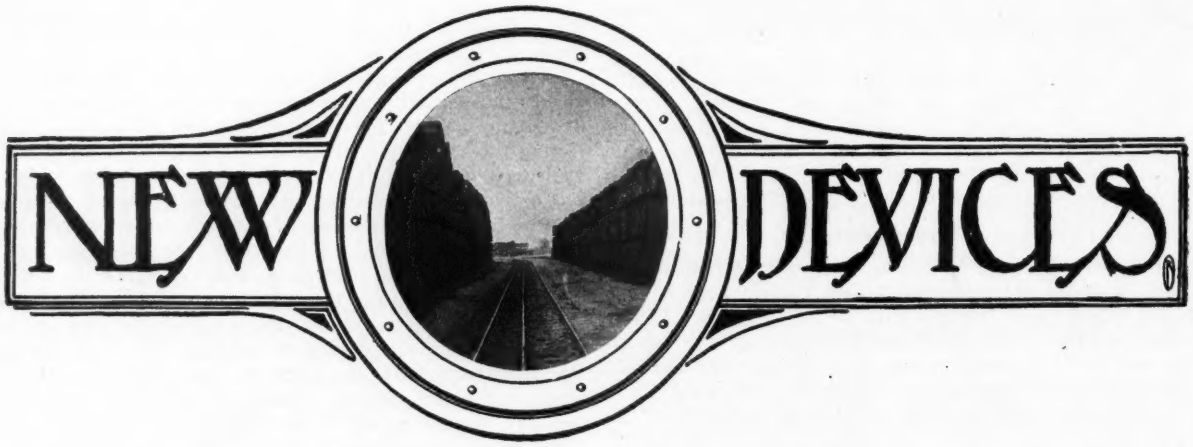
Unless the ballast is wet, or in such a condition that there is little danger of its running, there is no advantage in jacking out ties where they are averaging only one or two to the panel, as more uniform results can be had by jacking the joints and centers an equal amount. In foul ballast where the track is somewhat buried a man can improve the track by jacking uniformly and thus "giving it air" with a slight touch of ballast quickly applied inside and out under the remaining ties.

Where this is permissible it will be found that the new ties will go in more readily and take a good bearing from the start. They should, however, be placed ahead of trains in every case in order to secure the advantage of this temporary lift. Many foremen are inclined to jerk out two or more pole lengths of old ties before placing the new ones. This is poor practice unless traffic is very light and the gang small.

Care must be exercised to see that the expansion of the rail is such as to allow track to be handled with jacks, as it is found that nearly all buckled rail occurs in the early spring. On one-way track this work can be handled successfully only "against the traffic"—a point too often overlooked when the surface of anchor ties is disturbed.

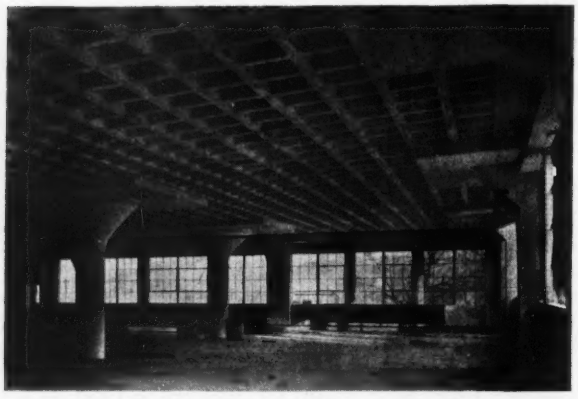
The practice of slacking spikes on ties adjacent to the ones being removed, in order to remove the rails without disturbing the old ties, is bad and has the tendency to cause men to bunch the renewals to secure economy.

E. KEOUGH,
Assistant Engineer Maintenance of Way, Canadian Pacific, Montreal, Que.



A Modified Type of Flat Slab Construction

AN UNUSUAL type of flat slab construction has recently been used in building work, which, because of its final appearance, has been given the name of Grid flat slab construction. Some of the advantages stated for this design are a saving of from 20 to 30 per cent in concrete and from 10 to 20 per cent in steel, less permanent dead weight, increased spans, less labor, etc. The construction of floors and roofs consists of columns with the usual capitals and drop panels, but differs from the ordinary practice in the provision of recesses in the under side of the main slab, thereby forming a two-way T-beam construction. These recesses are obtained by the use of removable forms, pressed out of 16-gage steel in one piece. The drop panel over the columns is reinforced near the top for negative moment, while the grid

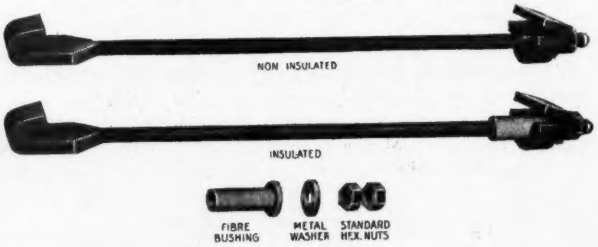


An Interior in a Grid Slab Building

slab is reinforced near the bottom of the ribs for positive moment. This type of reinforced concrete floor experiences the general elastic deformation of the usual flat slab construction and is being designed with the use of the same moment coefficients as other flat slabs. The removal steel forms are 8 in. deep and 19 in. square with a 2½-in. flange. In installing them preparatory to construction they are placed tight up to each other or the equivalent of 24 in. center to center, the 2½-in. flange, thus forming a 5-in. rib. Each form replaces 1.45 cu. ft. of concrete. In actual use, the forms are nailed to the woodwork, which can be of lighter construction than usual, the lumber required for supporting the domes being about two board feet per square foot of floor area. Owing to the fact that the steel forms, or domes, as they are often called, are flat on top and strong, planking or runs can be laid upon them and concrete wheeled over the top. The type of slab has been developed by the Grid Flat Slab Corporation, Boston, Mass.

A New Gage Rod for Switches and Curves

AMONG THE new devices that were exhibited for the first time at the Coliseum during convention week was a new form of gage rod designed for use at switches and on curves. It consists of a single rod, one end of which is formed into a jaw to engage the base of the rail and the other end threaded and carrying a jaw for the other



Details of the Gage Rods

rail in the form of a forging designed to fit loosely on the rod and to be held in place by two nuts applied to the rod. The rod itself is made of rolled and forged steel, while the adjustable jaw is made from a ¾-in. steel plate. Each jaw is shaped to fit any base of rail.

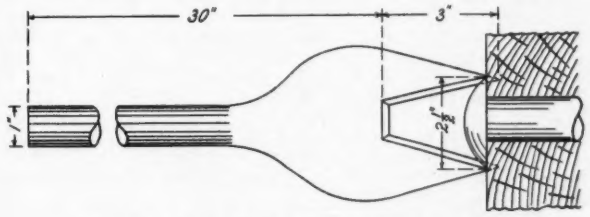
The chief purpose in the development of the new rod was to provide a means of adjustment for wear, the new rod requiring only the screwing up of the nuts to take up any wear that occurs in the rod. This rod also eliminates the use of turnbuckles and other parts.

Another feature of the new rod is its adaptability for use either non-insulated or insulated, the conversion being effected simply by adding a fibre bushing on the threaded end of the rod. This bushing has a collar which bears against the wide, flat surface of the forged jaw and is protected on the outside by a large metal washer kept in place by the two nuts. By this method of installation it is only necessary to carry one style of rod in the shop for either non-insulated or insulated work.

The principal use of the gage rod is at switches and on heavy curves. At switches the rod either takes the place of the gage plate or is used in addition to it. The device is a development of the Bethlehem Steel Company, Inc., Bethlehem, Pa.

A Tool to Facilitate the Removal of Bolts

IN MAINTAINING timber bridges it is frequently necessary to remove or tighten button-headed bolts on which the nuts have become rusted. When these bolts are loose in the holes and the threads are badly corroded, it is necessary to secure a sufficient grip on the heads to hold them from turning while the nut is being started. If a pinch bar is used the timber is damaged. To meet this condition, J. J. Tyree, a bridge carpenter on the Norfolk & Western, has devised a tool which is now being used on the Norfolk division of that road. This tool is simply a one-inch steel bar, 33 in. long, of 0.70 carbon steel, one end of which is flattened to form a tapered end 4 in. wide through the heavy section and having a V-shaped notch in the end to fit over the bolt head, the end of the bar being ground to a point and the sides of the notch to a cutting edge. When a loose bolt is encountered the head is held fast by driving the bar into the timber far enough to cut



How the Guard Rail Bolt Holder Is Applied

into the edge of the bolt head, the width across the notch at the point being wider than the bolt head purposely so that the points will penetrate into the timber before striking the bolt head, thus avoiding the tendency to slip off when driving. This tool is reported to have shown marked advantages in work of this character.

A Double-Drum Air Hoist

IN THE *Railway Maintenance Engineer* of September, 1921, there was published a description of a turbine type of air hoist developed by the Sullivan Machinery Company, Chicago. This was a single-drum machine designed to supplant manual power in the smaller operations where hoisting and pulling operations are involved. This company has now developed a double-drum hoist. As with the single-drum hoists, two drums, each 10¾ in. in diameter with a 5⅛ in. face, are mounted on the same central standard with and completely enclose the motor, to which compressed air is admitted through a central inlet port. The power is transmitted from the motor to the drums by a driving pinion at each end of the motor which engages an internal gear on each drum shell. The two drums are controlled independently by both friction clutches and band brakes, the clutches being placed at the outer ends of the drums and the brake bands on the inner ends. By this method either drum may be operated separately or both may be thrown into gear at the same time, thus adapting the machine for scraper work where it is desired simultaneously to pull on one rope and pay out on another, or in derrick work where it is desired to operate the boom from one hoist and the hoisting line from the other.

The double drum machine weighs 555 lb., accommodates 225 ft. of 5/16-in. wire rope on each of the two drums and will lift 2,000 lb. vertically at a speed of 110 ft. per min. with 75 lb. air pressure. The horsepower developed is 6½. This hoist takes the ordinary size ¾-in. hose connection and, similarly to the single drum hoist, is equipped throughout with ball bearings.

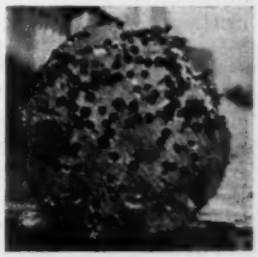
The advantages claimed for the machine are several. The hoist weighs only 85.4 lb. per horsepower and is said to require much less air than cylinder and piston machines. It is capable of operating on wide variations

The Sullivan Double-Drum Turbine Air Hoist

of pressure and is unusually powerful and rapid in its operation. Further distinctive features of the machine lie in its compactness, the ease of operation and the facility with which it can be moved from place to place and set up in unhandy places. Where it is desired to utilize the machine in slusher work, the brakes are not used, the handles being thrown out of the way and the brakes and bands removed completely.

Teredo are Active in Seattle Harbor

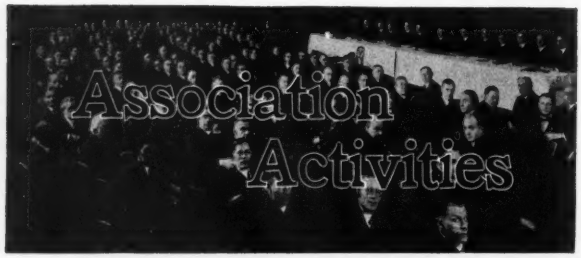
THE ACTIVITY of teredo along the North Pacific coast is indicated by an examination which was made recently of a pile taken from Elliott Bay in the harbor of Seattle, Wash. When erecting a derrick foundation alongside pier No. 1 of the Northern Pacific last September, the pile driving crew tapped the piles with the hammer in the vicinity of the point where the derrick was to be built to determine their physical condition. When the hammer was dropped on the pile shown in the illustration, the portion above the ground broke off. It was then pulled out and cut up in sections in order to ascertain how badly it had been affected by the teredo with the results shown in the photograph.



Section of Badly Affected Pile

This pile was treated and driven in 1909 under specifications requiring 12 lb. of creosote, although the indications are that this amount was not injected. This pile stood about 48 ft. back from the wharf line and 23 ft. from the building line; the mud line was 54 ft. below cut-off where the pile gave way.

REORGANIZED.—The receivership of the Missouri, Kansas & Texas Railway and the Missouri Kansas & Texas Railway of Texas, ended on April 1, except for the line from Coalgate, Okla., to Oklahoma City. The reorganized corporation will be known as the Missouri-Kansas-Texas Railroad Company.



Maintenance of Way Club of Chicago

Hal S. Ray, assistant to president of the Chicago, Rock Island & Pacific, was the speaker at a meeting of the Maintenance of Way Club held in the rooms of the Western Society of Engineers' on Wednesday, April 25. Mr. Ray talked on the present situation of the railroads with respect to public relations and urged all railway men to inform themselves thoroughly regarding railroad affairs, in order that they may take an active part in combating the enormous volume of misinformation which is being circulated by irresponsible individuals and organizations.

Metropolitan Track Supervisors' Club

The regular meeting of the Metropolitan Track Supervisors' Club was held on Saturday, April 14, at the Hotel Martinique, New York, with an attendance of approximately 50 members and guests. The question of the advisability of holding the annual meeting of the Roadmasters' Association regularly in Chicago and the possible changing of the meeting date to correspond with that of the American Railway Engineering Association was discussed at length. Following the discussion, a resolution was unanimously adopted to the effect that, in the opinion of the Metropolitan Track Supervisors' Club, the conventions of the Roadmasters' Association should not be held in one city from year to year and that in the event of the adoption of such a policy the date should not be changed to correspond with that of the A. R. E. A. The subjects of rail creeping and ballast cleaning, presented at previous meetings, were presented again for further discussion.

The Wood-Preservers' Association

The Hotel Muehlebach has been selected as the headquarters for the next convention, which will be held in Kansas City, Mo. The date has been set forward to January 15-17, inclusive. The National Association of Railroad Tie Producers has also changed the date of its convention to January 17-18 in the same hotel.

The following subjects have been assigned to committees for investigation during the ensuing year:

Preservatives.—(a) Continue the study of oils derived from vertical retort, blast furnace and low temperature tars and similar products; continue the study of creosote specifications, particularly with reference to the coke and float tests; study the thermal expansion of creosote, tars and creosote-coal-tar solutions and prepare tables; continue study of methods of analysis of sodium flouride; prepare specifications for creosote oil for surface treatment covering high boiling anthracene oils. Ernest Bateman (chairman), chemist, Forest Products Laboratory, Madison, Wis. (b) Use of petroleum oil with creosote oil or other toxics. R. S. Belcher (chairman), manager, treating plants, A. T. & S. F., Topeka, Kan. (c) Make a complete study of the history of the use of zinc chloride as a wood preservative from its earliest beginning to the present time; determine what improvements can be made in the manner of its use and in the method of its application; determine under what conditions timber treated with zinc chloride can be expected to yield an adequate return on the investment. Hermann von Schrenk (chairman), consulting timber engineer, St. Louis, Mo.

Treatment.—(a) *Ties.*—Prepare specifications for preservative treatment of cross ties, switch ties and bridge ties (except Douglas fir). J. R. Helson (chairman), superintendent, Watkins Creosoting Company, Metropolis, Ill. (b) *Fir Ties.*—Investigate and report on various methods of seasoning and treating Douglas fir; prepare specifications for preservative treatment of Douglas fir cross ties, switch ties and bridge ties. H. E. Horrocks (chairman), manager, Pacific Creosoting Company, Seattle, Wash. (c) *Car Lumber.*—Gather information showing the average life of different parts of car material treated and the life obtained from those same parts in untreated cars wherever it is possible to get such information; report on the kind of treatment most economical to use; prepare specifications for preservative treatment of car material. F. S. Shinn (chairman), supervisor, C. B. & Q. treating plant, Galesburg, Ill. (d) *Timber.*—Prepare specifications for the preservative treatment of timber (4 by 4 and larger). H. R. Condon (chairman), assistant forester, Penna., Philadelphia, Pa. (e) *Piling.*—Prepare specifications for preservative treatment of piling. W. J. Kelleher (chairman), general manager, Southern Creosoting Company, Ltd., Slidell, La. (f) *Poles, Pressure.*—Clarify and extend examination of life histories of full-cell process poles; clarify and extend examination of life histories of empty-cell process poles; obtain further information relative to the use and results obtained from empty-cell treatments of poles in Europe; prepare specifications for preservative treatment of poles. C. C. Fritz (chairman), treating engineer, Long Bell Lumber Company, Kansas City, Mo. (g) *Poles, Non-Pressure.*—Determine the effect of seasoning and other factors upon penetration with the view of developing improvements in perforating patterns and economy in plant operation; secure detailed treating and setting records on representative pole lines in the eastern, southwestern and western territories. L. L. Hill (chairman), secretary, Page & Hill Company, Minneapolis, Minn. (h) *Posts.*—Prepare specifications for preservative treatment of posts. W. J. Smith (chairman), tie and timber agent, M. K. & T., St. Louis, Mo. (i) *Inspection.*—Prepare recommended practices in inspection of preservative treatments. F. N. Graham (chairman), chief timber inspector, C. G. W., Chicago.

Utilization and Service.—(a) *Track Service Records.*—Extend the table in 1923 report of ties per mile used in renewals since 1900 on various roads to include the principal roads which have used treated ties for some time, and add data for 1922 on all roads reporting; obtain additional reports of service records from the Forest Products Laboratory, and compile addendum to the table printed in 1922 Proceedings; compile progress reports on special test tracks on the U. P., the C. B. & Q., the C. M. & St. P., the A. T. & S. F, and the C. & O., Z. M. Briggs (chairman), assistant engineer maintenance, Penna., Pittsburgh, Pa. (b) *Posts.*—Secure all data possible covering use of treated posts; secure any information available showing comparison between treated, untreated, concrete and steel posts. W. J. Smith (chairman), tie and timber agent, M. K. & T., St. Louis, Mo.

Research.—Steam Treatments.—Continue experiments on effect of steaming and vacuum treatments upon moisture content, using additional species and additional steaming and vacuum treatments; start intensive study and experimental work on effect of steaming and vacuum on absorption and penetration of preservatives; study the rate of heat transfer in wood; secure all information available from service records bearing on the effect of steaming on the serviceability of wood; obtain such information as may be found possible upon (a) effect of steaming on strength and (b) safe steaming periods and temperatures; collect information on present steaming practice throughout the country. George M. Hunt (chairman), Forest Products Laboratory, Madison, Wis.

American Railway Engineering Association

The Board of Direction has selected the personnel of committees and the subjects for their consideration for the ensuing year. Three changes have been made in the chairmen of committees, the new encumbents being as follows: C. R. Knowles, Committee on Water Service; S. D. Cooper, Committee on Wood Preservation; C. C. Cook, Committee on Economics of Railway Labor. In addition a new committee on Co-operative Relations with Universities has been created with R. H. Ford as chairman.

An outline of the subjects assigned to the committees, together with the name of their chairman, follows:

Roadway.—Methods of filling bridges; the effect of heavier power and increased tonnage upon roadbed previously stable; deferred construction costs chargeable to track laying and surfacing; corrugated metal culverts, preparing specifications; revise existing grading specifications; assist Committee on Uniform

Contract forms in revising grading contract; method of special treatment of culverts where there is a liability in blocking by storm water deposits; special treatment to prevent washing and deposits on right-of-way by water in side ditches; revision of roadway sections to meet requirements of standard ballast sections. C. M. McVay, division engineer, New York Central Lines, Charleston, W. Va.

Ballast.—Size of stone for ballast; mechanical tampers, with special reference to methods of use and handling; concrete foundations for crossings and tracks; ballasting by contract; cleaning ballast, with description of machines and cost data, both by hand and by machines. F. J. Stimson, chief engineer maintenance, Southwestern region, Pennsylvania System, St. Louis, Mo.

Ties.—Substitute ties, including design; ties of foreign woods in this country; dimensions of ties. W. A. Clark, chief engineer, Duluth & Iron Range, Duluth, Minn.

Rail.—Details of mill practice and manufacture as they affect rail quality; methods of reporting rail failures; rail joints and bolts, covering important dimensions affecting interchange of both and joint bar drilling on all R. E. sections of rail, with special reference to the 110-lb. section; this subject should include a study of the cause of battered rail ends and methods of correcting this defect, also the movement of contiguous rails through standard bolted joints with special reference to the force necessary to produce movement and the effect of lubricated contact surface between rail and joints; the desirable length of rails; material for joint bars and methods of treatment; sections for rails over 140 lb. per yard; transverse fissures; comparative wear of various weights of rail under similar traffic conditions; rail canting; the building up of battered rail ends. G. J. Ray, chief engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Track.—Detail plans of slip switches and crossings; plans and specifications for track tools; the effect of brine drippings on track appliances, with tests of tie plates subject to brine drippings; canting of rail inward and taper of tread of wheel; method for determining recommendations for rail renewals; curving of rails, recommending limits of curvature within which various weights of rail may be laid without having been previously curved; resawing and reconditioning of rails for relaying; tie plate plans; rail joints, assisting Committee on Rail; track construction in and across paved streets and highways. W. P. Wiltsee, acting chief engineer, Norfolk & Western, Roanoke, Va.

Buildings.—Freight house design; specifications for buildings for railway purposes; ice houses and icing stations; floors for railway buildings; ventilation of railway buildings; ornamental roof coverings for passenger stations; paint for railway buildings. W. T. Dorrance, designing engineer, New York, New Haven & Hartford, New Haven, Conn.

Wooden Bridges and Trestles.—The useful strength of new, old and treated timber when used in railway trestles, including a critical examination of the present theories of stresses when applied to timber under railway load conditions; the classification of uses of timber and lumber under American Railway Engineering Association specifications; a desirable system of bridge and trestle inspection, including the necessary report forms; the relative merits of open and ballast deck trestles. A. O. Ridgway, assistant chief engineer, Denver & Rio Grande Western, Denver, Colo.

Masonry.—Principles of design of concrete, plain and reinforced, for use in railway structures; represent the association on the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete; represent the association on the Joint Committee on Standard Specifications for Concrete Pipe; developments in the art of making concrete; co-operate with the Committee on Marine Piling Investigations of the National Research Council. C. C. Westfall, engineer bridges, Illinois Central, Chicago.

Signs, Fences and Crossings.—Substitutes for wooden crossing planks for highway crossings and city streets and prepare specifications for bituminous crossings; highway crossing grade separation, including a study of the laws of the various states and the practice of utility and highway commissions respecting the division of cost of eliminating highway grade crossings; the relative economy of steel, wood and concrete fence posts; end, corner and gate posts of concrete and a method of bracing them. Maro Johnson, assistant engineer, Illinois Central, Chicago.

Signals and Interlocking.—Confer with other committees and assist them when called upon in work which involves signaling; examine reports of other committees and recommend changes which may be necessary to permit proper signal practices. W. J. Eck, signal and electrical superintendent, Southern, Washington, D. C.

Records and Accounts.—Cost-keeping methods and statistical records; plans, methods and forms for gathering and recording data for keeping up-to-date the physical and valuation records of the property of railways; feasibility of reducing the number of forms used in the engineering and maintenance of way departments, combining forms and simplifying those retained; methods for recording and accounting for the determination of proper allowance for maintenance of way expenses due to increased investment, assisting Committee on Economics of Railway Operation; revision of the Interstate Commerce Commission Classification of Accounts. H. M. Stout, record engineer, Northern Pacific, St. Paul, Minn.

Rules and Organization.—Preparation of Manual of Rules for the Guidance of Employees of the Maintenance of Way Department. W. C. Barrett, trainmaster, Lehigh Valley, Sayre, Pa.

Water Service.—Regulations of federal or state authorities pertaining to drinking water supplies; pitting and corrosion of boiler tubes and sheets, taking into consideration the character of the metal used, method of manufacture, construction of boilers and quality of water; value of water treatment to railways; standard methods of water analysis and interpretation of results for inclusion in the Manual; automatic control of electrically-operated pumps; the use of lead as compared with substitutes for joints in cast iron pipe; methods of watering and showering live stock in transit; the use of treated wood for tanks. C. R. Knowles, superintendent water service, Illinois Central, Chicago.

Yards and Terminals.—Unit operation of railway terminals in large cities, including a revision of the catechism of unit operation of terminals as a statement of principles; scales (a) automatic indicating devices for weighing, (b) tolerances for railroad service weighing devices; freight handling at two-track level freighthouses and team tracks and multiple story freighthouses, also handling freight by mechanical means, including the relative advantages and disadvantages of the use of freighthouses as warehouses in connection with l. c. l. freight; freight yard design, suggesting economies in operation; the arrangement of terminals to reduce preparatory leaving time and terminal arriving time of trains, including the matter of main track capacity approaching important terminals; the proper size and arrangement of large passenger station facilities as determined by the business handled. A. Montzheimer, chief engineer, Elgin, Joliet & Eastern, Joliet, Ill.

Iron and Steel Structures.—Classification of bridges; specifications for the design of turntables; specifications for steel highway bridges; electric welding of connections in steel structures; rules for lighting bridges and uniform code of regulations and signals for the operation of drawbridges; the maintenance of railway bridges, including equipment for that purpose; rules for field inspection of existing bridges; investigations and tests on I-beams connected in groups by diaphragms and bracing, from which conclusions may be drawn and good practice in designing established; tests and a study of the behavior of bridge pins; column tests; methods of waterproofing and drainage of solid floor bridges as a preliminary to the drafting of specifications. O. F. Dalstrom, engineer of bridges, Chicago & North Western, Chicago.

Economics of Railway Location.—The economics of railway location as affected by the introduction of electric locomotives; units for comparing cost of maintenance of way, equipment and transportation; locomotive tractive force; methods of estimating speed, time and fuel consumption; relative merits of increasing tonnage by reducing ruling grades, or by the use of more powerful locomotives, including consideration of momentum grades, the availability of the locomotive booster and electrification. Edward C. Schmidt, professor of railway engineering, University of Illinois, Urbana, Ill.

Wood Preservation.—Service test records of ties; specifications for the preservative treatment of Douglas fir; co-operate with Committee on Marine Piling Investigation of National Research Council; the effect of preservatives on the inflammability of wood; preservative treatment for wood pipe staves; preservative treatment for signal trunking and capping; the treatment of poles and posts; plant design. S. D. Cooper, assistant manager treating plants, Atchison, Topeka & Santa Fe, Topeka, Kan.

Electricity.—Electrical interference caused by propulsion circuits, including recommendations for eliminating interference with signal, telephone and telegraph lines caused by propulsion circuits and adjacent transmission lines, collaborating with the appropriate committees of the Telegraph and Telephone Section and with the Signal Section, working with a view of submitting a joint report to the American Railway Association; the utilization of water power for electric railway operation, with special reference to the future development of water power from the St. Lawrence river; electrolysis, collaborating with the American Committee on Electrolysis, retaining membership thereon; collaborate with the United States Bureau of Standards in the revision of the National Electrical Safety Code and other codes of similar character; overhead transmission and distribution line construction for railroad use, preparing plans and specifications for such construction, collaborating with appropriate committees of the Signal Section and the Telegraph and Telephone Section, with the view of submitting a joint specification to the American Railway Association; assist Committee XVI—Economics of Railway Location, in its subjects 2 and 7; electric light, power supply and

trolley line crossings of steam railroads, keeping the association informed with regard to changes which may be desirable in the specifications submitted this year to make them conform more nearly to the requirements of part two of the National Electrical Safety Code, prepared by the United States Bureau of Standards, and to the requirements of the Public Service Commissions, or other regulatory bodies in the various states; continue the state representatives and their alternates; specifications for adhesive and rubber tapes, recommending any changes or modifications which may be required therein to maintain the specifications in conformity with similar specifications of the American Society for Testing Materials; insulators, knife and snap switches, with the view of preparing plans and specifications for standardizing these subjects, collaborating with the appropriate committees of the Signal Section and the Telegraph and Telephone Sections with the view of submitting joint reports and specifications to the American Railway Association; revision of the tables showing third rail clearances and the tables showing overhead working conductor clearances in the report for 1921; protection of oil sidings from danger due to stray currents, with the view of keeping up to date the rules for such protection submitted this year as recommended practice. Edwin B. Katte, chief engineer, electric traction, New York Central, New York City.

Uniform General Contract Forms.—Agreement for joint use of passenger and freight facilities (two agreements); agreement for hopper pit for loading device; agreement for placing snow or sand fences on private lands; standard form of option for purchase of land; agreement for purchase and sale of electricity; representation at Joint Conference on Standard Construction Contract; contract for grading. W. D. Faucette, chief engineer, Seaboard Air Line, Norfolk, Va.

Economics of Railway Operation.—Effect of speed of trains upon the cost of transportation; methods of increasing the traffic capacity of a railway; methods of analyzing costs for the solution of special problems; feasibility and economy of through routing of solid trains and its effect upon the capacity of terminals; methods for the determination of proper allowances for maintenance of way expenses due to increased use and increased investment; the utilization of locomotives to determine: (a) the percentage of time they should be available to perform actual transportation, (b) methods for obtaining maximum efficiency while so available. G. D. Brooke, superintendent transportation, Baltimore & Ohio, Western Lines, Cincinnati, Ohio.

Economics of Railway Labor.—Methods for obtaining and handling railway employees (studying methods in use in other industries); standard methods for performing maintenance of way work for the purpose of establishing units of measure of work performed; methods of programming maintenance of way work, looking to the most economical application of labor. C. C. Cook, maintenance engineer, Baltimore & Ohio, Baltimore, Md.

Shops and Locomotive Terminals.—General layouts of engine terminals; general layouts and designs of car shops; general layouts and design of coaling stations; typical layouts for the storage and distribution of fuel oil, including fuel oil stations between terminals; storehouses for shops and locomotive terminals. F. E. Morrow, assistant chief engineer, Chicago & Western Indiana, Chicago.

Co-operative Relations with Universities.—A greater interest upon the part of railroad officers in assisting the universities to develop the best possible methods for the technical courses; a better means of bringing to the universities the results of our deliberations, where such can be made of value to them; a better means of bringing to the attention of the railroads the benefits of a technical education, thereby acquainting them with the qualifications of graduates of these courses for initial service in subordinate positions, and at the same time providing material from which men may be drawn for higher positions as they demonstrate their fitness; a means of stimulating a greater interest in the science of transportation among engineering students who may be inclined toward this branch of industry; a means whereby the facilities of the universities may be made more directly available for the research work of the association by co-operative effort between their laboratories and the committees of the association; a means whereby the universities may be better enabled to educate the students and the public regarding the value of transportation to the nation as a whole; a means of stimulating a greater interest among university officials in the study of transportation and economics and impressing them with the importance of experienced men for such teaching. R. H. Ford, assistant chief engineer, Chicago, Rock Island & Pacific, Chicago.

Special Committee on Stresses in Railroad Track.—Continue work now in progress; prepare a short digest of results already accomplished by this committee; assist Committee on Ties, Track and Rail, in subjects assigned to them; make recommendations as to undertaking a series of tests to determine best method of testing steel rails. A. N. Talbot, professor of municipal and sanitary engineering, University of Illinois, Urbana, Ill.

The Material Market

WHILE PRICES continue to advance, there are evidences of a lessening demand, which should serve as a brake on the upward tendency. The scrap market has been weak for some time, showing reductions in prices as compared with last month. The lumber market also is not as strong as it was a month ago, the result, apparently, of a reduced volume of orders in some localities. However, on the whole the general tendency of the market is still upward, as may be noted from the table of prices below. There have even been rumors of an advance in the price of rail on July 1 to $47, but this is not looked for. The rail market is again active as evidenced by orders for considerably more than 100,000 tons of rail within the last 10 days. Business in track fastenings has also been active, one manufacturer in Chicago having recently sold 25,000 kegs of spikes. Structural steel awards also continue on an active basis and the shops now have orders on their books for approximately 90 per cent of capacity.

Prices in Cents Per Pound

	March 25		April 20	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	2.40 to 3.15	.... 3.15	.... 3.15	.... 3.25
Track bolts	4.00 to 4.50	.... 4.15	4.00 to 4.50	.... 4.25
Angle bars	.... 2.75	.... 2.75	.... 2.75	.... 2.75
Tie plates, steel	2.55 to 2.60	.... 2.60	2.55 to 2.60	.... 2.60
Tie plates, iron	....	.... 2.75	....	.... 2.85
Plain wire	2.65 to 2.75	2.99 to 3.09	2.90 to 3.10	3.24 to 3.44
Wire nails	2.80 to 3.00	3.14 to 3.34	2.65 to 3.00	2.99 to 3.34
Barbed wire, gal.	3.45 to 3.70	3.79 to 4.04	3.70 to 3.90	4.04 to 4.24
C. I. pipe, 6 in. or larger, per ton	....	.... 57.20	....	.... 57.20
Plates	2.25 to 2.50	2.45 to 2.84	2.45 to 2.90	2.50 to 3.19
Shapes	2.25 to 2.50	2.45 to 2.84	2.45 to 2.60	2.50 to 3.19
Bars, soft steel	2.25 to 2.50	2.35 to 2.84	2.35 to 2.75	2.40 to 3.19
Open hearth rail per gross ton f. o. b. mill				$43.00

Comparison of the current prices of scrap as compared with those of a month ago discloses reductions in nearly all of the items.

	Prices Per Gross Ton at Chicago March	April
Relaying rails	$32.00 to $35.00	$32.00 to $35.00
Rerolling rails	25.00 to 25.50	24.00 to 24.50
Rails less than 3 ft. long	26.50 to 27.00	26.00 to 26.50
Frogs and switches cut apart	25.00 to 24.50	22.50 to 23.00
	Per Net Ton	
No. 1 railroad wrought	21.00 to 21.50	20.00 to 20.50
Steel angle bars	23.00 to 23.50	22.00 to 22.50

Reported sales in the southern pine territory indicate an appreciable reduction in business as compared with corresponding period for 1922. This has been reflected in some reduction in prices as indicated in the table below. Lumber sales in Douglas fir territory continue good, and thus far no reductions have been noted.

Southern Pine Mill Prices

	March	April
Flooring, 1x4, B. and B. flat	$53.35	$53.65
Boards, 1x8, No. 1	42.70	39.00
Dimension, 2x4, 16, No. 1, common	31.40	32.15
Dimension, 2x10, 16, No. 1	32.90	32.60
Timbers, 4x4 to 8x8, No. 1	31.25	29.80
Timbers, 3x12 to 12x12, No. 1	....	42.59

Douglas Fir Mill Prices

Flooring, 1x4, No. 2, clear, flat	44.00	44.00
Boards, 1x6, 6x20, No. 1, common	20.50	20.50
Dimension, 2x4, 16, No. 1, common	23.50	23.50
Dimension, 2x10, 16, No. 1, common	23.50	23.50
Timbers, 6x6 to 8x8, No. 1, common	18.00	25.00
Timbers, 10x10 to 12x12, rough	25.00	26.50

No changes have been reported in the current prices of Portland cement. The following are current prices per barrel in carload lots not including package:

Chicago	$2.20	Duluth	$2.14
Cincinnati	2.54	Milwaukee	2.37
Davenport	2.43	Minneapolis	2.39
Detroit	2.47	Pittsburgh	2.24

Beginning June 1, 1923, cement will be sold by the Universal Portland Cement Company by the sack instead of by the barrel. Prior to that date, the price per sack will be determined by dividing the price per barrel by four. On quotations and sales made on and after June 1, the price will be figured by the sack.

General News

The Metropolitan Life Insurance Company has $226,000,000 invested in the securities of the railroads.

Major J. G. Steese, engineer corps of the United States Army, has been selected to take charge of the Alaska Railway.

The Canadian National will before long establish a pension system for employees, according to an announcement made by G. P. Graham, acting minister of railways, in Parliament on April 9.

The Michigan Central now has two cars in service equipped with roller bearings. At various times during a period of service of one of the cars which now exceeds 25,000 miles, micrometer measurements have failed to reveal any evidence of wear, either on the rollers or the bushings.

The Atchison, Topeka & Santa Fe has announced that employees may become stockholders in the company through a plan recently adopted under which the stock will be purchased in the market by the road and held for employees, who may pay for it at the rate of $10 a month.

Eight persons were killed and 15 or more injured when westbound passenger train No. 11, the Southwestern Limited, of the Cleveland, Cincinnati, Chicago & St. Louis, traveling at high speed, struck an automobile at a crossing near Columbus, Ohio, on March 30, derailing the locomotive and four sleeping cars.

The Chicago & North Western, the pioneer railroad in the safety first movement, reports a decrease of 41 per cent in the number of employees killed; 12½ per cent in the number of passengers killed, and 28 per cent in the number of outsiders killed during the period since June 30, 1910, as compared with an equal period prior to June 30, 1910.

According to the Interstate Commerce Commission's monthly summary of wage statistics, the number of employees reported by Class I roads for the month of January, 1923, was 1,779,516, a decrease of 9,074, or 0.5 per cent, as compared with the returns for December, 1922. The total compensation was $250,051,786, an increase of $2,379,271, or 1 per cent.

According to Figures published by the Department of Commerce from compilations of the Bureau of Census, shipments of railroad locomotives from the principal manufacturing plants increased to 282 in March and were the highest since December, 1920. Unfilled orders continued to increase and made a new high record at 2,316 locomotives, an increase of 96 during the month.

According to the Interstate Commerce Commission's monthly summary of traffic statistics, the ton miles of revenue freight handled by the Class I railroads during January totaled 33,941,844,000. This compares with a total of 23,741,680,000 in January, 1922, and represents an increase of 44 per cent. The freight revenue was $366,039,762, as compared with 276,527,265, or an increase of 33 per cent.

Julius Kruttschnitt, chairman of the executive committee of the Southern Pacific Company, in a letter to Senator Couzens of Michigan, replying to his charge that the American railroads had not increased in efficiency in the last 18 years and that they were now seeking to make savings primarily by wage reductions, asserts that out of a reduction of approximately $1,000,000,000 a year in the labor cost of railway operation only about $350,000,000 represents decreased wages. The balance, almost two-thirds, has been the result of efficiency and economy of operation. He shows that during the past 18 years the increase in power of each locomotive, plus the increase in the number of locomotives, produced an increase of 97 per cent in the aggregate power of freight locomotives, which moved 139 per cent more revenue ton-miles.

The Class I Railroads in February had a net railway operating income of $38,903,000, which represented a return on an annual basis of 3.73 per cent on their tentative valuation, according to reports filed with the Interstate Commerce Commission. The net operating income in February last year amounted to $47,727,000, which was on the basis of an annual return of 4.67 per cent. In January this year their net operating income totaled $60,654,700 or 5.54 per cent.

The Car Service Division of the American Railway Association has prepared an estimate of the car loadings for the remainder of 1923, which indicates a maximum for the week of October 20 of 1,085,000 cars. The previous record was made in the week of October 14, 1920, when 1,018,539 cars were loaded with revenue freight and during the war year 1918, the maximum, reached in the week of September 23 was 989,788 cars.

The Secretary of Commerce has sent a recommendation to President Harding that in view of the tremendous activity in construction work throughout the country the government shall not undertake for the present any but the most necessary work under the building program authorized by Congress at the last session, but that the work be held in abeyance with a view to employing idle men during the next period of depression.

A bill has been introduced in the state legislature of Minnesota to require the railways in that state to limit each section of main line track to a maximum of six miles and to maintain on each section a minimum force of a foreman and three men. Branch line sections are limited to a maximum of eight miles of main track, exclusive of sidings and wyes, and the force to a foreman and two men. Violation of this act is to be punishable by a fine of not less than $25 nor more than $100, each violation for a period of 24 hours being a separate offense.

In 1922 the railroads expended $200,000,000 for cars, $45,000,000 for locomotives and $195,000,000 for trackage and other facilities. They have authorized expenditures for equipment and other facilities of approximately $1,100,000,000 for 1923, divided as follows:

For cars	$ 515,000,000
For locomotives	160,000,000
For trackage and other facilities	425,000,000
	$1,100,000,000

Statistics of the Interstate Commerce Commission furnishing the following information on the increase in railways mileage which occurred in the six years ending with 1915, and the decrease in mileage which occurred in the six years ending with 1921, were as follows:

	Miles Inc.		Miles Dec.
1910	5,908	1916	214
1911	4,740	1917	411
1912	3,301	1918	96
1913	3,003	1919	377
1914	2,511	1920	307
1915	831	1921	801
Total 6 years	20,294	Total 6 years	2,206

Personal Mention

General

W. W. K. Sparrow, assistant to the president of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, and an engineer by experience, has been elected vice-president in charge of the financial and accounting departments, with the same headquarters. Mr. Sparrow was born in Ireland on December 30, 1879, and entered railway service in 1896 in the engineering department of the Belfast & Northern Counties Railway. In 1899 he went to South Africa, where he entered the service of the South African Railways and was engaged in location, construction and maintenance work. He came to the United States in 1909 and entered the service of Waddell & Harrington, consulting engineers, Kansas City, Mo., and a short time thereafter became connected with H. von Unwerth, consulting engineer, of the same city. He served with the Missouri Public Service Commission from 1913 to 1916, first as assistant chief engineer and then as chief engineer, and was then appointed valuation engineer of the Chicago, Burlington & Quincy. During federal control he was chief engineer of the Chicago, Milwaukee & St. Paul, and upon its termination was appointed assistant chief engineer, a position he held until June of the same year, when he was promoted to assistant to the president in charge of valuation and settlements with the Railroad Administration. He was placed in charge of the accounting, valuation and real estate departments with the same title in 1920.

W. W. K. Sparrow

John J. Pelley, at one time a roadmaster on the Illinois Central, and more recently general superintendent of the northern lines of that road, has been promoted to general manager, with headquarters at Chicago. Mr. Pelley was born on May 1, 1878, at Anna, Ill., and entered railway service on August 29, 1900, as a track apprentice on the Carbondale division of the Illinois Central. On August 1, 1904, he was promoted to supervisor on the Indiana division and on November 1, 1905, was transferred to the Memphis division of the Yazoo & Mississippi Valley. From January 15, 1908, to June 6, 1911, he served as roadmaster on the Louisiana division of the Illinois Central, with headquarters at New Orleans, La., and on the latter date was transferred to the Tennessee division, where he remained until May 10, 1912, when he was promoted to superintendent of that division, with headquarters at Fulton, Ky. Consecutively since that time he served as superintendent of the Memphis division, general superintendent first of the Southern lines, with headquarters at New Orleans, La., and later of the Northern lines, and since 1920 successively as chairman of the Chicago Terminal Car Service Commission and manager of the Refrigerator Car section of the Car Service division of the American Railway Association, in which latter capacity he was serving at the time of his recent appointment.

John J. Pelley

G. R. Barry, whose promotion to division superintendent of the Richmond division of the Pennsylvania, with headquarters at Richmond, Ind., was noted in the April issue, was born at Hillsboro, Ill., and was educated at the University of Illinois. He entered railway service in June, 1899, as a track apprentice on the Illinois Central and in February, 1900, left this road to become a rodman on the Pennsylvania Lines West of Pittsburgh. In January, 1906, he was promoted to assistant division engineer. He was promoted to division engineer on February 1, 1912, and continued in this capacity until March 1, 1920, when he was promoted to division superintendent. Upon the consolidation of divisions, he was again appointed division engineer in March, 1921, with headquarters at Logansport, Ind., in which capacity he was serving at the time of his recent promotion.

G. R. Barry

D. F. Stevens, an engineer by education, has been promoted to general superintendent of the Northwest district of the Baltimore & Ohio, with headquarters at Cleveland, Ohio. He was born on November 4, 1882, at Minneapolis, Minn., and studied civil engineering at Cornell University. He entered railway service in June, 1899, as a clerk on the Great Northern and two years later joined a survey party as axman. He left this work in June, 1902, to become timekeeper on the Canadian Pacific, returned to the Great Northern in June, 1903, as a rodman, and in May, 1904, entered the service of the Chicago, Rock Island & Pacific as a gang foreman. He was appointed clerk in December, 1904, and held this position until September, 1905, when he again returned to the Great Northern, this time as a roadmaster. He returned to the Rock Island in May, 1907, as a gang foreman, was appointed yardmaster on the New York, New Haven & Hartford in October, 1907, became trainmaster in February, 1908, and was promoted to terminal trainmaster in October, 1913. Since entering the service of the Baltimore & Ohio in May, 1914, he was assistant supervisor of fuel consumption until November, trainmaster until May, 1915, assistant superintendent until January, 1916, and superintendent successively of the Newark division, the Newcastle division and the Akron division, his location at the time of his recent promotion to general superintendent of the Northwest district.

D. F. Stevens

C. E. Brinser, engineer maintenance of way of the Eastern Pennsylvania division of the Pennsylvania, with headquarters at Harrisburg, Pa., has been appointed superintendent of the Louisville division, with headquarters at Louisville, Ky., succeeding **T. Hamilton,** transferred. Mr. Brinser was born on December 3, 1881, at Elizabethtown, Pa., and was educated at Franklin and Marshall College. He entered railway serv-

ice in April, 1900, as a rodman in the construction department of the Philadelphia division of the Pennsylvania and on March 9, 1903, was promoted to transitman at Altoona, Pa. From September, 1903, to April, 1907, he was assistant supervisor on the Trenton division and from April, 1907, to August, 1910, was supervisor on the Delaware division, on the latter date becoming division engineer on the New York, Philadelphia & Norfolk (Pennsylvania Railroad). In 1913 he became division engineer of the Camden Terminal division and from December, 1914, to September, 1916, was division engineer on the West Jersey & Seashore (Pennsylvania Railroad). In September, 1916, he became division engineer of the Monongahela division; was transferred to the Middle division in April, 1917, and on October 25, 1917, was transferred to the Philadelphia Terminal division. From September 1, 1918, to March, 1920, he was successively assistant superintendent of the New York division, with headquarters at Jersey City, N. J., and assistant division superintendent, with headquarters at Trenton, N. J., being appointed engineer maintenance of way of the Eastern Pennsylvania division in March, 1920, the position he held at the time of his recent appointment.

Engineering

S. A. Seely has been appointed division engineer of the Adirondack and Ottawa divisions of the New York Central, with headquarters at Utica, N. Y.

J. B. Duncan, Jr., has been appointed water service supervisor on the Southern Pacific, with headquarters at Dunsmuir, Cal., succeeding **J. G. Wiley**, assigned to other duties, as noted elsewhere in these columns.

G. H. Wilsey, structural engineer of the St. Paul Union Depot Company, at St. Paul, Minn., has been appointed principal assistant engineer in charge of the design and construction of the new passenger terminal. **W. B. May** has been appointed assistant engineer in charge of construction.

J. R. Leighty, engineer, western group, President's Conference Committee of valuation, has been appointed special engineer in charge of valuation of the Southern, with headquarters at Washington, D. C., succeeding **D. W. Lum**, who has been appointed consulting special engineer of valuation on account of ill health.

G. J. Bell, district engineer of the Western district of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., has been transferred to the Eastern district, with the same headquarters, succeeding **W. C. Baisinger**, promoted. **F. Helm**, office engineer, with headquarters at Topeka, Kan., has been promoted to district engineer of the Western district, with the same headquarters, in place of Mr. Bell.

S. L. Church, division engineer of the Baltimore division of the Pennsylvania, with headquarters at Baltimore, Md., has been promoted to engineer maintenance of way of the Illinois division, with headquarters at Chicago, succeeding **F. H. Watts**, who has been transferred to the Lake division, with headquarters at Cleveland, Ohio, in place of **J. B. Baker**, who has been transferred to the Eastern Pennsylvania division, with headquarters at Harrisburg, Pa., vice **C. E. Brinser**, promoted, as noted elsewhere in these columns.

M. S. Blaiklock, engineer maintenance of way of the Grand Trunk, Lines East of the Detroit and St. Clair rivers, with headquarters at Montreal, Que., pursuant to the reorganization of the Canadian National and Grand Trunk, has been appointed assistant chief engineer of the Canadian National, with the same headquarters. **Col. C. N. Monsarrat**, consulting engineer of bridges of the Canadian National, with headquarters at Toronto, Ont., has been appointed consulting engineer, with headquarters at Montreal, Que. **J. A. Ellis** has been appointed assistant engineer of roadway standards of the Canadian National, with headquarters at Montreal, Que., and **R. O. Stewart** has been appointed assistant engineer of bridge standards, with headquarters at Montreal. **J. A. Heaman**, assistant chief engineer of the Canadian National, Western Lines, with headquarters at Winnipeg, Man., pursuant to the reorganization of the Canadian National and Grand Trunk, has been appointed regional assistant chief engineer of the Western region of the Canadian National, with the same headquarters. **J. E. Davison**, assistant to chief engineer of the Western Lines, with headquarters at Winnipeg, has been appointed assistant to regional chief engineer of the Western region, with the same headquarters. **J. G. LeGrand**, bridge engineer of the Western lines, with headquarters at Winnipeg, has been appointed bridge engineer of the Western region, with the same headquarters. **W. Walkden**, assistant bridge engineer of the Western lines, with headquarters at Winnipeg, has been appointed assistant bridge engineer of the Western region, with the same headquarters. **D. R. Campbell**, general superintendent construction of the Western lines, with headquarters at Winnipeg, has been appointed general superintendent construction of the Western region, with the same headquarters. **William Burns**, engineer of construction of the Western lines, with headquarters at Winnipeg, has been appointed construction engineer, with the same headquarters. **G. C. Briggs**, engineer of buildings of the Western lines, with headquarters at Winnipeg, has been appointed building engineer of the Western region, with the same headquarters. **H. P. Blake**, engineer of water supply of the Western lines, with headquarters at Winnipeg, has been appointed water supply engineer of the Western region, with the same headquarters. **J. W. Porter** has been appointed special engineer of the Western region, with headquarters at Winnipeg. **Thomas Turnbull**, engineer maintenance of way of the Western lines, with headquarters at Winnipeg, has been appointed engineer maintenance of way of the Manitoba and Saskatchewan districts of the Western region, with the same headquarters. **F. B. Tapley**, engineer maintenance of way of the Eastern lines, with headquarters at Moncton, N. B., has been appointed engineer maintenance of way of the Alberta and British Columbia districts, with headquarters at Edmonton, Alta.

W. A. Duff, engineer of standards of the Canadian National, with headquarters at Toronto, Ont., has had his jurisdiction extended to include the Grand Trunk pursuant to the reorganization made necessary by the absorption of the Canadian National and that road. Mr. Duff was born on April 20, 1877, and was educated at Toronto University. Immediately following the completion of his studies in 1907, he entered railway service as chief draftsman in the bridge department of the National Transcontinental Railway with office at Ottawa, Ont. In the following year he was promoted to assistant bridge engineer, with the same headquarters. In 1913 he was appointed engineer of bridges of the Canadian Government Railways, with headquarters at Moncton, N. B., and in 1916 was promoted to assistant chief engineer, with the same duties as engineer of bridges and others. In 1921 he was appointed engineer of standards of the Canadian National, in which capacity he was serving at the time of his recent appointment, as noted above.

W. A. Duff

C. S. Gzowski, whose appointment as chief engineer of the construction department of the Canadian National, with headquarters at Montreal, Que., was noted in the April issue, was born in Toronto, on May 1, 1876, and studied at Bishop Ridley's College, St. Catherines, Ont., from 1890 to 1894, and at the School of Practical Science of the University of Toronto, which he attended from 1894 to 1897, at intervals during which he worked in the engineering department of various railroads. In 1905, after being engaged for two years on railway location and construction for the Canadian Pacific and other roads in Ontario and the western provinces, he entered the service of the builders of the Nicola, Kamloops and Similkameem branch of the Canadian Pacific from

Spence's Bridge, B. C., and in 1906, became a partner in Macdonnell, Gzowski & Company, with headquarters at Vancouver, B. C. Thus associated, he was in charge of a considerable mileage of railway construction in British Columbia, Montana, Idaho, and Washington; including the spiral tunnels of the Canadian Pacific at Field, B. C. In 1914 he entered private engineering practice and in 1916 was appointed valuating engineer for the Royal Commission of Inquiry into Railways and Transportation. Subsequently he was engaged by the directors of the Canadian Northern to assist in the arbitration of the value of their stock, and from January, 1918, to April, 1919, was engaged in special work for the vice-president of that road, whereupon he was appointed special engineer to the vice-president of operation, maintenance and construction. He was appointed assistant to the vice-president of construction in October, 1920, and served in that capacity until his recent appointment as noted above.

W. L. Breckinridge, assistant chief engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago, has retired on account of ill health after 44 years of service. Mr. Breckinridge was born on June 29, 1857, at Louisville, Ky., and graduated from Washington University, St. Louis, Mo., in 1879, immediately following which he entered the service of the Chicago, Burlington & Quincy as a rodman. He became assistant engineer a short time later and was subsequently advanced to division engineer. He was next promoted to engineer of the Iowa lines, which position he held until 1898, when he became superintendent of the same line. In 1899, he was promoted to chief engineer of the lines east of the Missouri river, with headquarters at Chicago, in which capacity he continued until 1918, when he was appointed chief engineer of the Burlington system for the United States Railroad Administration. Upon the termination of Federal control in 1920, he was appointed assistant chief engineer of the system, with headquarters at Chicago, and was serving in this capacity when illness compelled his retirement. During the 44 years of his continuous service, the Burlington grew from a line of 1,709 miles of lines to the present system of 9,389 miles.

W. L. Breckinridge

B. E. DeLamater has been appointed assistant engineer maintenance of way on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Galion, Ohio, succeeding **H. J. King,** resigned. Mr. DeLamater was born at Norwalk, Ohio, on August 18, 1890, and attended Purdue University from 1909 to 1913. He entered railway service in 1913 as a rodman on the Wheeling & Lake Erie, later serving as bridge inspector. In 1915 he entered the service of the Cleveland, Cincinnati, Chicago & St. Louis, as an assistant in an engineering corps, and in September, 1921, was transferred to the Cincinnati office, where he was engaged in valuation work under the assistant valuation engineer. In June, 1922, he was promoted to engineering accountant, which position he held until March 1, 1923, when he was transferred to the Cincinnati office in charge of the department of expenditures, in which capacity he was serving at the time of his recent appointment.

Track

A. E. Moquist has been appointed roadmaster of the Tracy district of the Stockton division of the Southern Pacific, with headquarters at Tracy, Cal., succeeding **Paul Lorentzen,** retired.

P. F. Nichols has been appointed supervisor of track of subdivision No. 3 of the Meadville division of the Erie, with headquarters at Meadville, Pa., succeeding **W. D. Groover,** assigned to other duties.

F. G. Chambers has been appointed roadmaster of the Third district of the Salt Lake division of the Denver & Rio Grande Western, with headquarters at Thistle, Utah, succeeding **E. M. Sparks,** resigned.

W. H. Ogelvie has been appointed roadmaster on the Nebraska-Colorado division of the Chicago, Rock Island & Pacific, with headquarters at Belleville, Kan., succeeding **W. H. Dick,** who has been transferred to Colorado Springs, Colo., in place of **J. A. Sullivan,** deceased.

Tim Kennedy, general roadmaster on the Denver & Salt Lake, with headquarters at Denver, Colo., has been appointed roadmaster of the Third district of the Green River division of the Denver & Rio Grande Western, with headquarters at Soldier Summit, Utah, succeeding **D. Quinn,** transferred.

Harry M. Petry, whose promotion to roadmaster on the First district of the Kalispell division of the Great Northern, with headquarters at Essex, Mont., was noted in last month's issue, was born at Westminster, Md., on April 2, 1887, and entered railway service on December 24, 1904, as a section foreman on the Minot division of the Great Northern. From April 1, 1910, to March 15, 1917, he was a section foreman on the Butte division, and from April 1, 1919, to July 15, 1919, served in the same capacity on the Havre division. On the latter date, he was promoted to district roadmaster on the Havre division, which position he held until July 20, 1920, when he was appointed section foreman on the Havre division, the position he held at the time of his recent promotion.

John Thiessen, whose promotion to roadmaster of the Third district of the Los Angeles division of the Los Angeles & Salt Lake, with headquarters at Las Vegas, Nev., was noted in last month's issue, was born at Samara, Russia, on November 13, 1877, and took the International Correspondence School course in railroad engineering. He entered railway service in 1894 as a section laborer on the Atchison, Topeka & Santa Fe, at Glendora, Cal., and in 1898 was promoted to assistant foreman on extra gangs and relief section foreman. After a year's absence from railway service, he returned in 1901 as a boilermaker's helper on the Atchison, Topeka & Santa Fe, at Newton, Kan., and was promoted to boilermaker in 1903. In 1903 he became a section foreman on the Los Angeles & Salt Lake at Riverside, Cal., and was promoted to extra gang foreman at San Pedro, Cal., in 1908, later serving as section foreman at various points until his promotion to roadmaster, as noted above.

Bridge and Building

V. E. McCulloch has been appointed assistant general bridge inspector on the Chicago & North Western.

T. H. Thompson, scale inspector on the Chicago, St. Paul, Minneapolis & Omaha, has been promoted to general foreman of bridges and buildings, with headquarters at Worthington, Minn., succeeding **Oscar Magnuson,** resigned.

J. G. Wiley, water service supervisor on the Southern Pacific, with headquarters at Dunsmuir, Cal., has been appointed supervisor of bridges and buildings, with the same headquarters, succeeding **C. W. McCandless,** transferred.

F. E. Shanklin, supervisor of bridges and buildings on the Chicago & North Western, with headquarters at Chadron, Neb., has been transferred to the Madison division, with headquarters at Madison, Wis., succeeding **W. H. Mulcahy,** retired. **Paul Paulson** has been appointed supervisor of bridges and buildings on the Dakota division, with headquarters at Huron, S. D., in place of **T. H. Durfee,** transferred.

H. R. Leonard, engineer of bridges and buildings of the Pennsylvania, with headquarters at Philadelphia, Pa., has been appointed to the newly created position of chief engineer of bridges and buildings, with the same headquarters. **Robert Farnham,** assistant engineer of bridges and buildings, with headquarters at Philadelphia, Pa., has been promoted to engineer of bridges and buildings, with the same headquarters, succeeding Mr. Leonard. **James F. Leonard,** assistant engineer of bridges, with headquarters at Pittsburgh, Pa., has

been appointed engineer of bridges and buildings, with the same headquarters.

Purchases and Stores

J. W. Taylor, assistant to the president of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, has been elected vice-president in charge of the purchasing and stores department, with the same headquarters.

A. E. Cox, general storekeeper of the Canadian National, with headquarters at Winnipeg, Man., pursuant to the reorganization of the Canadian National and the Grand Trunk, has been appointed general storekeeper. **D. Robertson,** assistant general storekeeper, with headquarters at Transcona, Man., has been appointed assistant general storekeeper of the Western region, with headquarters at Winnipeg, Man. **E. J. McVeigh,** general storekeeper of the Grand Trunk, with headquarters at Montreal, Que., has been appointed general storekeeper of the Central region, with headquarters at Toronto, Ont., and **E. D. Toye** has been appointed assistant general storekeeper of the Central region, with headquarters at Toronto. **W. E. Logan** has been appointed general storekeeper of the Atlantic region, with headquarters at Moncton, N. B.

Obituary

W. M. Sweeneey, supervisor of bridges and buildings on the Chicago & North Western, at Green Bay, Wis., died on April 26.

William Murtaugh, track supervisor on the Chicago region of the Erie, with headquarters at Decatur, Ind., died on March 14. Mr. Murtaugh was born on January 1, 1870, at Woodruff, W. Va., and entered railway service on the Baltimore & Ohio, where he was employed until 1913, when he was appointed supervisor on the Chicago & Erie, a subsidiary of the Erie Railroad, at Decatur, Ind., in which capacity he was serving at the time of his death.

John G. Rodgers, vice-president of the Northwestern region of the Pennsylvania, with headquarters at Chicago, and an engineer by experience, died on April 11. Mr. Rodgers was born on November 14, 1862, and entered railway service in 1882 as a rodman on the Pennsylvania. Prior to January 1, 1900, he had served consecutively as rodman, assistant engineer on construction, assistant to the chief engineer, assistant supervisor and supervisor. He was appointed superintendent of the New York, Philadelphia & Norfolk, a part of the Pennsylvania System, on January 1, 1900, and served in that capacity until March 24, 1909, when he was promoted to assistant to the general manager. On March 3, 1911, he was promoted to general superintendent and on September 20, 1917, was promoted to assistant to the president. He was elected vice-president in charge of the Northwestern region, with headquarters at Chicago, on March 1, 1920. Mr. Rodgers was granted an extended leave of absence on February 1 of this year due to ill health.

John G. Rodgers

An inspection in October, 1922, disclosed 44 piles supporting a bridge on the Burnett branch of the Northern Pacific to be in an excellent state of preservation after 44 years of service, during the first 22 years of which, they were in service in sea water. These piles were driven by the Southern Pacific to support a coal dock at Tacoma in 1887, at which time each pile was covered with sheets of copper. When removed in 1898, the copper sheets were found in good condition and the piles were free from attack. Thereafter 44 of them were redriven in the Northern Pacific's bridge.

Construction News

The Arkansas Short Line has applied to the Interstate Commerce Commission for authority for the construction of a line from McCormick to McDonald, Ark., 32.6 miles.

The Atchison, Topeka & Santa Fe will construct an icing dock 1,000 ft. long and will extend its yard tracks at Glendale, Ariz. The cost of the project will be approximately $50,000.

This company also contemplates the construction of a new line between Corona, Cal., and Elsinore. This company has authorized the construction of 13 miles of second track from Mission, Kans., to Burton, and is considering the construction of a cut off at Los Angeles, Cal., to connection with the Coast Line near Bakersfield, to provide direct service from San Francisco to Los Angeles.

This company is preparing plans for the construction of new locomotive and car shops at Kansas City, Kan., to cost approximately $250,000.

The Atlantic Coast Line has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of two, 500-ton capacity, three track, reinforced concrete, automatic electric locomotive coaling plants, at Florence, S. C., and Rocky Mount, N. C. This company will spend $26,000,000 on new facilities and equipment, of which the latter will require about $10,000,000. A second main track will be provided, giving the company a double track line from Richmond, Va., to Jacksonville, Fla. Additional yard tracks and sidings will be built on practically every division. Shop facilities will be increased and equipment added to at a number of places, including Wilmington and Rocky Mount, N. C., and Montgomery, Ala. Improvements will be made in station facilities, and grades will be reduced in a number of places.

The Boston & Maine has awarded a contract to the Pittsburgh Wood Preserving Company, Pittsburgh, Pa., for the construction and operation of a tie treating plant at Nashua, N. H. The plant will have two cylinders with an aggregate capacity of 1,200,000 ties per annum.

The Calgary & Fernie will construct a line 50 miles from Sparwood, B. C., to Mount Wilson. The construction of this road was begun in 1912, but discontinued at the beginning of the war. The total length of the projected line is 157 miles, and it will cost approximately $3,500,000. Franklin Crandell, Calgary, Atla., is one of the directors of the company.

The Canadian National Railways contemplates the early completion of its line to Hudson Bay, according to G. P. Graham, acting minister of railways of Canada.

The Canadian Pacific will construct a line from Cutknife, Sask., to Withford Lake; the first two sections (approximately 50 miles long) of the line from Milden, Sask., to Empress; the first two sections (approximately 50 miles long) of the line from Leader, Sask., into the territory south of that town; and the first section (approximately 25 miles long) of the line from Wymark, Sask, to Archive. A line will be built in conjunction with the Canadian National from Drumheller, Alberta, to Bull Pound, a distance of 39 miles.

The Central Pacific has applied to the Interstate Commerce Commission for authority to construct the proposed Natron cut-off from Oakridge to Kirk, Ore., 118 miles, as an alternative line between Springfield Junction, Ore., and Weed, Calif. The directors of the Southern Pacific had promised to build this line if authorized to retain control of the Central Pacific.

The Chesapeake & Ohio has awarded contracts to the Brooks-Callaway Company and the Hardaway Company, Atlanta, Ga., to construct additions to its yards at Clifton Forge, Va., to provide a terminal consisting of ten 100-car tracks, a double track hump with scales on each track and 20 classification tracks of sufficient length to hold 100 cars. The cost will be approximately $3,500,000. The work to require the moving of a portion of the city of Clifton Forge and the

village of Selma—80 houses in all and the relocation of a highway, also changing the channel of the Jackson river at two places and carring the entire yard across the river. The work will involve 2,000,000 cu. yd. of excavation; 25,000 cu. yd. of concrete; 1,300,000 ft. B. M. timber in cofferdam; 138 tons of reinforcing steel; 3,600 tons bridge steel.

The Chicago & North Western closed bids on April 2 for the construction of a four-story brick office building in Chicago, to cost approximately $150,000.

The Chicago, Burlington & Quincy plans, as a part of its construction program for this year, the construction of 30 miles of second track, including some re-alinement to cost $2,200,000; the enlargement of yards to cost $800,000; the construction of shops, roundhouses and engine terminals to cost $1,300,000; and the construction of water and coaling stations to cost $350,000.

The company has awarded a contract to the T. S. Leake Construction Company, Chicago, for the construction of the passenger station at Weston, Mo., reported in the February issue. A contract has also been awarded both to the T. S. Leake Construction Company, for a seven-stall addition to the roundhouse at Aurora, Ill., as reported in the April issue and to G. A. Johnson & Sons, Chicago, for the construction of a five-stall addition to the roundhouse at Eola, Ill., as reported in the April issue.

This company closed bids on April 10 for the construction of an extension to the roundhouse at Galesburg, Ill., and closed bids on April 20 for remodelling the erection shop at Beardstown, Ill.

The Chicago, Milwaukee & St. Paul plans the construction jointly with the Chicago, St. Paul, Minneapolis & Omaha and the Great Northern, of a reinforced concrete and steel viaduct over the tracks of these companies at Tenth street, Sioux Falls, S. D., to cost approximately $140,000.

The Chicago, North Shore & Milwaukee (Electric) will construct a new car shop at Waukegan, Ill., to cost approximately $1,000,000.

The Chicago, Rock Island & Pacific has awarded a contract to the Flick Construction Company, Chicago, for the grading in the construction of the second track between Paxico, Kan., and Volland and between Herington and Latimer, reported in the March issue. The contract for the bridge work has been awarded to the Cedar Rapids Construction Company, Cedar Rapids, Iowa. This company is receiving bids for the construction of an eight-stall roundhouse at Haleyville, Okla.

The City of Montreal contemplates the rebuilding of a subway under the tracks of the Canadian Pacific at Ontario street and another under the Grand Trunk tracks at Wellington street, the cost of both works to total approximately $425,000.

The Cleveland, Cincinnati, Chicago & St. Louis has purchased the freight yard and terminal of the Lake Erie & Western at Indianapolis, Ind., and is filling in the entire yard to raise the grade to the level of the Indianapolis Union tracks. The team tracks will be elevated and additional tracks will be constructed to give the yard a capacity of 240 cars. The total cost of the work will be approximately $550,000.

The Detroit, Toledo & Ironton has begun the construction of a 14 mile double track cut off from the main line at Flat Rock, Mich., to the plant of the Ford Motor Company at River Rouge, Detroit, where a large classification yard will also be built.

The Duluth & Iron Range has awarded a contract to Roberts & Schaefer Company, Chicago, for the construction of a 2,000-ton capacity reinforced concrete, automatic electric locomotive coaling plant at Two Harbors, Minn., to cost approximately $70,000.

The Edward Hines Yellow Pine Trustees are seeking permission from the Interstate Commerce Commission for the construction of an extension of their line in Mississippi to a connection with the Louisville & Nashville. The new line would extend from the present southern terminus at Klin to the L. & N. line at Bay St. Louis, Hancock county, Mississippi.

The Elgin, Joliet & Eastern has awarded a contract to the T. S. Leake Construction Company, Chicago, for the construction of a 20-stall roundhouse at Gary, Ind., reported in the April issue.

This company has awarded a contract to the Roberts & Schafer Company, Chicago, for the construction of two reinforced concrete automatic electric coaling plants of 1,000 tons' capacity, at Gary, Ind., and Joliet, Ill. Each station will cost $100,000.

The El Paso & Southwestern has awarded a contract to Anderson Brothers, El Paso, Tex., for the construction of a ten-stall addition to the roundhouse at El Paso, as reported in the April issue. The company also plans the construction of a coaling plant at Tucumcari, N. M.

The Great Northern will construct a new roundhouse, machine shop and power plant at St. Cloud, Minn., at a cost of $500,000 reported as contemplated in the January issue.

The Illinois Central closed bids on April 12 for the construction of a water treating plant at Clinton, Ill., and will construct two 100,000 gal. capacity water tanks and will lay 12,500 ft. of 10-in. pipe at Crystal Springs, Miss., with company forces. This company has awarded a contract to Railway Water & Coal Handling Company, Chicago, for the laying of pipe lines at Dunlap, Iowa, and Mt. Pulaski, Ill.

This company has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a passenger station at Homewood, Ill. This company has awarded a contract to the Drumm Construction Company, Chicago, for the construction of a brick suburban passenger station at Seventy-ninth street, Chicago, as reported in the March issue. A contract has also been awarded to the Drumm Construction Company for the widening of Eleventh street, Chicago, in front of the Twelfth street passenger station. This company will construct a 300-ton coal chute at Dubuque, Iowa. Bids were closed on March 27 for the construction of three subways in Chicago as a part of the Markham yard construction. This company has authorized the separation of grades in the city of Champaign, Ill., and will construct five subways for the accommodation of street traffic. A two-story brick passenger station with connecting express and baggage buildings are included in the project at Champaign and the total cost will be approximately $1,000,000.

This company will construct 7½ miles of second main track from Springfield, Ill., to Spaulding, and will construct with company forces passing tracks totaling approximately 12,000 ft. in length at Martwick and McHenry, Ky., and Hanson and Binney, Ill. A spur track, 4,000 ft. long will be constructed at Irwin, Ill. This company has awarded a contract to R. L. Frazier, La Center, Ky., for the grading of the second track at Clinton, Ill. This company's application for authority to build a new single track line from Edgewood, Ill., via Metropolis to Fulton, Ky., reported in the March issue, was the subject of a hearing at Cairo, Ill., during April, before an examiner of the Interstate Commerce Commission, in which citizens of Cairo, Centralia and other towns protested against the construction of the new line.

The Kanawha & West Virginia has applied to the Interstate Commerce Commission for authority to extend its line 33 miles beyond Swiss, W. Va.

The Kentucky & Indiana Terminal plans the enlargement of the yards and additions to the shop facilities at Louisville, Ky., to cost $2,000,000.

The Kettle Valley will construct a new passenger station at Oliver, B. C., and a new stores building and coal handling plant at Penticton, B. C.

The Longview, Portland & Northern has awarded a contract to Twohy Brothers, Seattle, Wash., for the construction of 26 miles of track from Kelso, Wash., in a northerly direction.

The Maine Central has completed plans for the construction at Rigby, South Portland, of a roundhouse with capacity for 40 locomotives and facilities for running repairs of locomotives. The plans also provide for a large interchange and classification freight yard. It is expected that these facilities will be available for use December 1, 1923.

The Michigan Central, having settled legal complications interfering with the construction of its proposed bridge over

the Niagara river at Niagara Falls, N. Y., will call for bids for the foundation of this structure in the near future.

The Missouri Pacific closed bids on April 11 for the construction of a 120-ft. by 160-ft. machine shop at Wichita, Kan.

This company closed bids on April 20 for the construction of pumping stations, water tanks and pipe lines at Camden Ark., Barham, Kenova and El Dorado, Kan.

This company has been ordered by the Supreme Court of Missouri to construct a viaduct and elevate its tracks over those of the St. Louis-San Francisco at the intersection west of Tower Grove station, near St. Louis, Mo. The cost of the viaduct is estimated at $200,000, of which the Missouri Pacific is to pay three-fourths and the St. Louis-San Francisco the balance.

The Montana Railroad, known as such in Montana, and as the Wyoming North & South Railroad in Wyoming, and of which J. M. Haskell, 347 Madison avenue, New York City, is the president, and George. M. Huss, Sheridan, Wyo., is the chief engineer, will construct a line 320 miles long from Miles City, Mont., via the Tongue river to Sheridan, Wyo., thence to Buffalo, Wyo., and to the Salt Creek oil fields. Connections will be made with the Chicago, Burlington & Quincy and the Chicago & North Western near Bucknum, Wyo. Contracts for the grading have been left to Roberts Bros., Peterson, Shirley & Gunther, of Omaha, Neb., as have the contracts for track laying and the construction of bridges. Some bridges will be of steel construction but most will be of timber. There will be one tunnel 700 ft. in length.

The New York, Chicago & St. Louis has announced a construction program for this year which includes 39 mi. of second track to cost $1,218,000; 11 mi. of yard and passing track to cost $300,000; improvements to shop and enginehouses to cost $242,000 and the construction of a coaling station to cost $15,000. The elimination of a number of grade crossings at a cost of $732,000 is also planned.

The Northern Pacific has authorized the construction of additional sewerage facilities at St. Paul, Minn., to cost $250,000 and the realinement of the main line at Tacoma, Wash., to cost $200,000, and has applied to the Interstate Commerce Commission for authority to construct a branch line of 30 miles in Rosebud county, Montana.

The Oregon Short Line has applied to the Interstate Commerce Commission for a certificate for the construction of a line to extend from Ada to Perkins, Ida., a distance of 27.25 miles.

The Pacific Electric has prepared plans for the construction of a complete subway system with a central station under Pershing square, Los Angeles, Cal., to cost $20,000,000, and has also prepared plans for the construction of a subway from Hill street station to First street and Glendale boulevard in Los Angeles. The projected line will be double tracked for a length of 4,200 ft. and is expected to cost $3,000,000.

The Pacific Fruit Express plans the construction of an addition to the ice manufacturing plant at Roseville, Cal., to cost approximately $150,000.

The Pennsylvania closed bids on April 10 for the completion of a proposed crossing over the Pennsylvania Railroad, Pittsburgh Terminal division, Millvale, Pa., the work to include 7,800 cu. yd. excavation; 12,800 cu. yd. masonry; and 65,000 lb. reinforcing steel.

This company has awarded a contract to the Hughes-Foulkrod Company, Pittsburgh, for the erection of walls and roof for its new shops at Juniata. The Wilson & English Construction Company has the contract for foundation and flooring and the McClintic-Marshall Company for the structural steel frame. The building will be 340 ft. by 690 ft. and will be equipped with two 250-ton cranes, four 50-ton cranes and 50 pits. The shop will have a capacity for heavy repairs to 100 locomotives a month. The company has under consideration and review various plans for the rearrangement of its facilities at Newark, N. J., including a new passenger station. This company has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a coaling and cinder handling plant at Clarks Tank, Ohio.

The Pere Marquette has awarded a contract to the Dominion Construction Company for the construction of 15 miles of second track between Delray, Mich., and Plymouth. This company has awarded a contract to the Arnold Company, Chicago, for the construction of a roundhouse at Grand Rapids, Mich., and will construct a power plant at the shops at Wyoming, Mich., to cost approximately $100,000.

The Philadelphia & Reading has awarded a contract to the Fred A. Havens Company, Philadelphia, Pa., for the construction of a new freight house at East Trenton, N. J., the new building to be of brick construction, one story, 30 ft. by 75 ft. with a 40 ft. by 125 ft. platform. Coincident with the building of the freight house, the yards will be enlarged to have a capacity of 45 cars. The cost of the work will approximate $50,000.

The Portland Terminal Company has awarded a contract to Roberts & Schaefer Company, Chicago, for the construction of a gravity sand plant with Beamer Sand dryers at Portland, Me.

The St. Louis-San Francisco has awarded a contract to Grant Smith Company, St. Louis, Mo., for the construction of second track from Valley Park, Mo., to Eureka. This company has also awarded contracts to E. T. White, Kansas City, Mo., and John R. Scott, St. Louis, Mo., for the reduction of grade at Dixon, Mo., to cost $100,000.

This company will also construct a 15-stall roundhouse and additional shop building at Monett, Mo., to cost approximately $500,000, to replace facilities recently destroyed by fire, and received bids during April for the construction of a new passenger station at Altamont, Kan.

The St. Paul Union Depot Company has awarded a contract to Foley Brothers, St. Paul, for the construction of the third stage of its union station project, which will include two additional stub tracks and four through station tracks, the extension of the waiting room over these tracks and the completion of the station facilities below them and the construction of a retaining wall on the west side of the tracks between Sibley and Mississippi streets.

The San Antonio, Medina Lake & Western, which has recently been incorporated in the state of Texas, proposes to construct a line from San Antonio, Tex., to Sonora, a distance of approximately 190 miles. At Sonora, connection will be made with the Kansas City, Mexico & Orient. The general offices of the line will be located in San Antonio.

The San Antonio Southern, which has received authority from the Interstate Commerce Commission to construct a line 250 miles long from Christine, Tex., to a point on the Rio Grande river, has already begun construction and 20 miles of the line has been graded. The projected line will extend from Christine to Roma, or Rio Grande City, and thence to Brownsville. The cost of this construction is estimated at approximately $4,000,000.

The Southern Pacific has awarded a contract to the Utah Construction Company, San Francisco, Cal., for the construction of 8 miles of first track from Wells, Nev., to Moor, for 21 miles of first track from Montello, Nev., to Valley Pass, and for 7 miles of first track from Truckee, Cal., to Andover. A contract has been awarded to the Erickson, Patterson & Grier Co., San Francisco, for the construction of 5 miles of second track from Blue Canon, Cal., to Emigrant Gap. The company called for bids for the construction of 11 miles of second track from Mojave, Cal., to Cameron.

This company plans the construction of a new roundhouse at Lafayette, La.

The Southern Pacific of Mexico, which was reported in the April issue as having authorized the completion of the line in Mexico from Tepic to a connection with the National Railways of Mexico at La Quemada, has let a contract for the grading to Twohy Brothers, Seattle, Wash. The contract for the bridges will be let later and track laying will be undertaken with company forces. Approximately 3,600,000 cu. yd. of rock and dirt will be moved per mile, the maximum grade being 1.5 per cent and the maximum curvature 6 deg. One steel viaduct 9,000 ft. long will be constructed as well as other shorter spans of steel and reinforced concrete. Thirty-three tunnels, aggregating about 26,000 ft. in length, will also be a part of the construction. E. B. Sloan, chief engineer at Tepic, Nayarit, Mexico, is in charge of the construction.

The Temiskaming & Northern Ontario Railway Commission and the government of the province of Ontario will decide within a few days whether or not a branch line of the Temiskaming & Northern Ontario will be built to Kirkland Lake.

The Texas, Panhandle & Gulf has been organized to carry out the plans which Col. C. H. Powell, of Chicago, and associates have been promoting for four years for the construction of a railroad between Seymour and Tucumcari, N. M., 303 miles. The route for the proposed road has been surveyed by Wallace & Noonan, consulting engineers, Chicago, and the right of way for most of the distance has been obtained. The line will pass through the towns of Truscott, Paducah, Tulia, Nazareth, Dimmitt, thence into New Mexico via Parmerton or Clovis. It is stated that the cost of constructing the proposed road will be approximately $11,000,000.

The Union Pacific has authorized the construction of 55 miles of second track on the Union Pacific and 10 miles of second track on the Oregon Short Line, as well as additional side tracks and yard tracks as a part of the construction program for this year.

The Wabash has been ordered by the Missouri Public Service Commission to depress its tracks under Delmar boulevard in St. Louis, Mo., the railroad to bear 60 per cent of the cost and the city 40 per cent. The depression of the tracks and the erection of the necessary viaducts is estimated to cost approximately $535,000.

Iron and Steel

The Boston & Albany received bids for the fabrication and delivery of 226,000 lb. of structural steelwork for a bridge 1.08 miles west of West Brookfield, Mass.

The Chesapeake & Ohio received bids for 3,500 tons of plate girders.

The Chicago & Eastern Illinois has ordered from the American Bridge Company 700 tons of structural steel in the form of deck and through plate girder spans, a through riveted truss span and I-beam spans.

The Chicago, Rock Island & Pacific has ordered 350 tons of structural steel from the American Bridge Company for turntables.

The Great Northern has ordered 325 tons of structural steel from the American Bridge Company, consisting of four 100-ft. turntables and repair material for other tables.

The Great Northern made inquiry during April for 790 tons of structural steel ore spouts, including bails and pins; also for 1,450 tons of structural steel door frames, doors, door chutes, track stringers, hoist supports, walk supports, railings, etc.

The Illinois Central issued an inquiry during April for 421 tons of structural steel.

The Ilinois Central has divided an order for 40,000 tons of steel rails between the Illinois Steel Company and the Tennessee Coal, Iron & Railroad Company.

The International-Great Northern has ordered from the Wisconsin Bridge Company 175 tons of structural steel consisting of two 100-ft. and one 50-ft. deck plate girders for a bridge over the Guadalupe river near Braunfels, Tex.

The Japanese Railways made inquiry during April for 1,170 tons of 75-lb. rail, also for 660 tons of 35-lb. rail and the South Manchuria an inquiry for 6,300 tons of 100-lb. rail.

The Norfolk & Western closed bids on April 18 for 2,000 tons of steel bars, shapes and plates for delivery during the fourth quarter of 1923.

The Toledo Terminal Railway has ordered 300 tons of structural steel from the American Bridge Company for use at Toledo, Ohio.

The Union Pacific has ordered 2,382 tons of structural steel from the American Bridge Company and 1,284 tons from the McClintic-Marshall Company.

The Western Pacific has ordered 345 tons of structural steel from the United States Steel Products Company for a viaduct at Keddie, Cal.

Supply Trade News

Major Frederic E. Wheeler, formerly president of Finlay-Wheeler, Inc., contractors' equipment dealers of Buffalo and Rochester, N. Y., has joined the Chicago sales staff of Blaw-Knox Company.

The Inland Steel Company is preparing plans for the enlargement of its No. 2 plant at Indiana Harbor, Ind., which will include four additional open hearth furnaces, which will increase the steel making capacity approximately 25 per cent.

Dwight P. Robinson & Company, Inc., New York, engineers and contracts, has opened a new office in Philadelphia, Pa., under the direction of Carl A. Baer, who was recently with the firm of Baer, Cook & Company, engineers, and a consulting engineer in the design of industrial, textile and power plants.

George Adam Weber, a director of the Rail Joint Company, New York, died at his home in Pasadena, Cal., on March 29, at the age of 75. Mr. Weber was one of the organizers of the Weber Rail Joint Manufacturing Company, which was one of the companies consolidated in 1905 to form the present Rail Joint Company.

H. S. Schroeder, formerly manager of the New York office of the Interstate Iron & Steel Company, Chicago, has been appointed sales manager of the bar division, with headquarters at Chicago. **F. C. Giebel** is now in charge of the New York City office at 52 Vanderbilt avenue. **R. W. Wentworth** is district sales manager of the St. Paul, Minn., branch office at 522 Merchants' National Bank building.

Robert F. Eissler, for the past two years assistant to the vice-president of the Chicago Pneumatic Tool Company, New York, has been appointed district manager at Pittsburgh. **Nelson B. Gatch,** district manager at New York, has been appointed assistant to vice-president, with the same headquarters, succeeding Mr. Eissler, and **William C. Straub** has been appointed district manager at New York, to succeed Mr. Gatch.

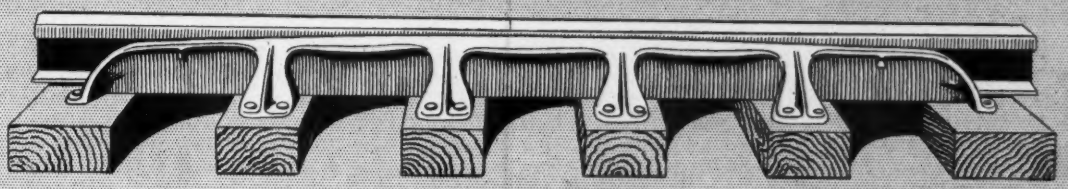
Trade Publications

Water Treatment.—The Graver Corporation, East Chicago, Ind., has issued an eight-page booklet describing the chemistry of zeolitic, water softening in general and the Graver process in particular. The booklet devotes some attention to the adaptablity of this form of treatment of purification of water containing scale forming matter and contains sectional views of the equipment provided for using it.

Oxy-Acetylene Outfit.—The Air Reduction Sales Company has issued a new catalog in the form of two booklets listing and describing, with illustrations, its line of oxy-acetylene welding and cutting apparatus and equipment, together with its tube welding machines and acetylene generators. The bulletins devote some attention to the history of these subjects, use of equipment and designate the field for which each type of apparatus listed is especially adapted.

Applying Science to Inhibit Rust.—The Dearborn Chemical Company, Chicago, has issued a booklet describing No-Ox-Id, a recently developed compound for use in protecting iron and steel surfaces against rust. A wide range of applications of the compound, which not only protects by providing a surface covering but inhibits the tendency toward corrosion under the ordinary protective coating, are set forth in the booklet, together with directions for its application by dipping, brushing or spraying, under various conditions.

Internal Combustion Engines.—The Stover Manufacturing & Engine Company, Freeport, Ill., has issued a 24-page booklet describing its line of internal combustion engines. The engines listed range from 1 to 30 hp. and include both the make-and-break type for gasoline and for kerosene fuels and the semi-Diesel type engine for burning fuel oil. Half-tone illustrations are given of the various models and specifications of each type are included with the descriptive matter.



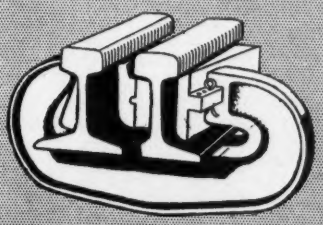
AJAX MANGANESE STEEL
ONE-PIECE GUARD RAIL

Ramapo and Ajax specialties have been long and favorably known under their individual names as manufactured by Ramapo Iron Works and Ajax Forge Company. These two companies are now consolidated into Ramapo Ajax Corporation, with five completely equipped works conveniently located for prompt deliveries to the railroads of the country. To assure service in the Western territory a stock of Ramapo Automatic Safety Switch Stands is carried at the Chicago headquarters.

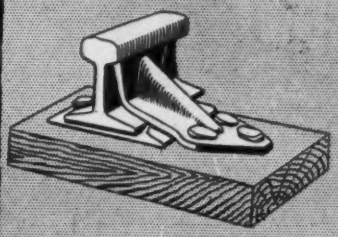
The Ramapo improved No. 20-B stand, placed on the market a year ago, has met with pronounced success. Repeat orders are coming in wherever it has been installed.

Other "RACOR" specialties not here illustrated include Switches, Frogs, Crossings, etc., Special Railway Track Work, Cast and Rolled Manganese Rail Construction, etc.

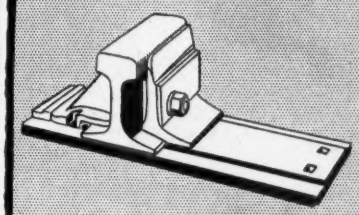
Particular attention is directed to the Ajax One-Piece Guard Rail at top of this page. Its combined simplicity and rigidity make this the most efficient and economical installation.



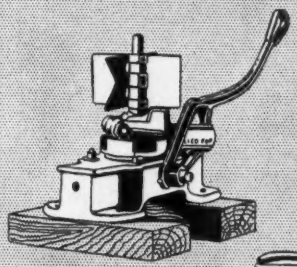
RACOR FORGED
HEAVY DUTY
GUARD RAIL CLAMP



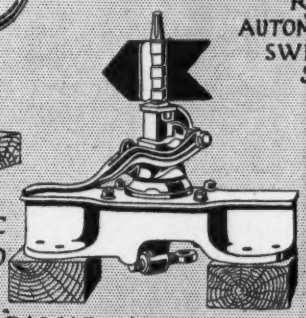
RACOR
FORGED RAIL BRACE



RACOR DOUBLE SHOULDER
SOLID BOTTOM
SWITCH RISER PLATE



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No 20-B



RAMAPO AUTOMATIC
SAFETY SWITCH STAND
Style No 19

RAMAPO
AUTOMATIC SAFETY
SWITCH STAND
Style No 18

RAMAPO
AUTOMATIC SAFETY
SWITCH STAND
Style No 17

RACOR

RAMAPO AJAX CORPORATION

RACOR

HILLBURN · NEW YORK

This Company is a consolidation of Ramapo Iron Works and Ajax Forge Co.

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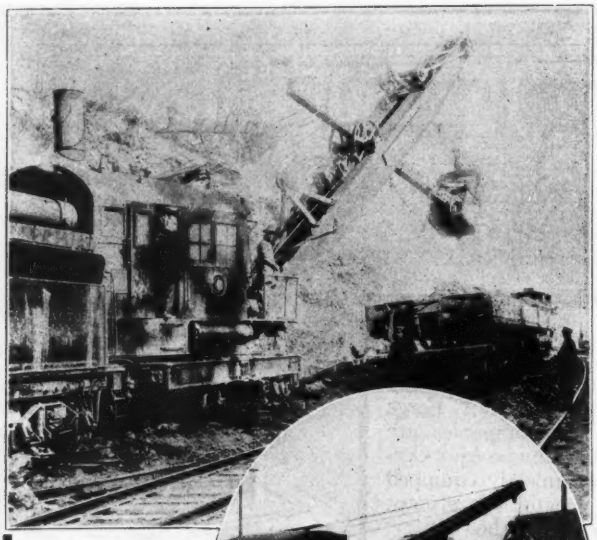
Canadian Ramapo Iron Works, Ltd., Niagara Falls, Ont.



With shovel attachment trimming high banks.

With bucket emptying ashes—cleaning ballast.

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Are in use on over 420 different railroads in United States, Canada, Mexico, Japan, China, Australia, India, Russia, France and Cuba.

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STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance*, published monthly at Chicago, Ill., for April, 1923.

State of New York, } ss.
County of New York }

Before me, a notary public in and for the State and County aforesaid, personally appeared Henry Lee, who, having been duly sworn according to law, deposes and says that he is the Vice-President of the Publisher of *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Company, Transportation Building, Chicago, Ill.

Editor, Elmer T. Howson, Transportation Building, Chicago, Ill.

Managing Editor, Walter S. Lacher, Transportation Building Chicago, Ill.

Business Manager, F. C. Koch, 233 Broadway, New York, N. Y.

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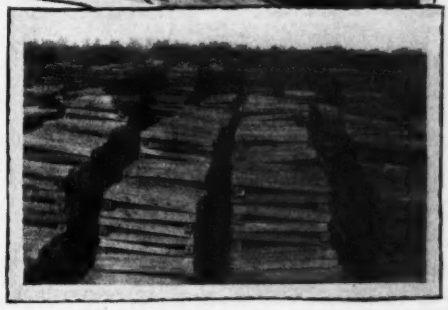
HENRY LEE.

[SEAL]

Sworn to and subscribed before me this 31st day of March, 1923.

HERBERT E. MCCANDLESS.
(My commission expires March 30, 1924.)



Meeting Facts with Facts

The A. R. E. A. Tie Specifications serve a double purpose. From the railroad standpoint they denote engineering requirements and set purchasing standards. From the tie producers standpoint the specifications enable him to proceed with an orderly uniform production of standard, marketable ties.

These specifications, to be effective, must be enforced uniformly at all times—if they are not, they become valueless and encourage unfair competition by a deceptive comparison of prices.

The fair enforcement of specifications stiffens competition between producers which eventually reacts to the benefit of the tie consumer. Furthermore, the tie operator can unhesitatingly produce uniformly standard ties during the entire year far in advance of receipt of orders—so that large quantities will be available to meet heavy seasonal demands.

The International Creosoting & Construction Company accepts the A. R. E. A. specifications in their entirety—and interprets it as its duty to enforce them to protect their customer and themselves and benefit the entire tie industry.

We maintain a "ship today" service on standard specification ties.

International Creosoting & Construction Co.

General Office—Galveston, Texas
Plants: Texarkana, Texas Beaumont, Texas
Galveston, Texas

International Treated Ties

Find Out What is Best for the Field —*Then Do It*

A B P Standard No. 10

"To determine what is the highest and largest function of the field he serves and then strive in every legitimate way to promote that function."

THIS is the tenth and last of our Standards—the capstone of our ethical structure. It has been subscribed to by the publisher of this paper, and by every other member of the A B P, Inc.

Back in 1921, when the outlook was rather discouraging, our publishers held a meeting in Chicago, the theme of which was "HOW to SPEED the REVIVAL of BUSINESS." A great publisher, an ex-President of the association, expressed the duty of business papers in these words:

> "But if the task be hard, if it require editors and publishers with big brains and great vision, the prospective reward is correspondingly great. Never has there been such an opportunity. Never were our industries more in need of help. Never would they be more grateful for full and true pictures of conditions, for wise counsel, and courageous leadership, as a result of unselfish devotion.
>
> "This is a time when we should think how much we can give, rather than how much we can get. We should give all that we can first, hoping that there may be a margin of profit.
>
> "This is a time for more patriotism, for greater leadership and less selfishness. The Business Papers must make the first investment living up to this thought. With the opportunities that are ours today, the watchword must be: Dividends small, Service large. We must be bulls on American business and not fear to make an investment in the affections and confidence of American business men."

We could ask for no finer commentary on the ideals back of Standard No. 10. For nearly an hour, this broad-visioned publisher elaborated upon the need for unselfish service, and he and the others went back home to do their mightiest to lift business up.

We have given you these intimate talks on our Standards because we believe you are entitled to know the moving forces which are back of the great organs of business which justly enjoy your confidence and support.

THE ASSOCIATED BUSINESS PAPERS, INC.

JESSE H. NEAL, *Executive Secretary*

HEADQUARTERS: 220 WEST 42nd STREET NEW YORK CITY

THE IDOL TRACK LINER

Illustration No. 1

Showing the Liner in position against the rail in track. The Liner is set at an angle to permit the farthest throw of the track. If the track must be moved more than 1½ inches, the Liner should be reset for each throw.

Illustration No. 2

Showing the Idol Track Liner in use as a tie spacer.

Illustration No. 3

Showing the Idol Track Liner raising low joints.

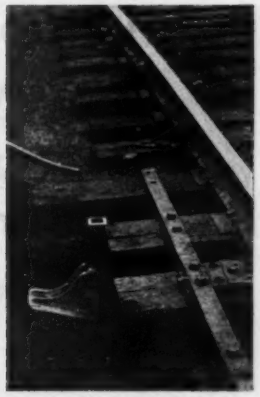


Illustration No. 4

Showing Liner in position at end of tie. Use Liner in this manner at switch points, or where spacer straps do not permit contact between the Liner and the base of the rail.

Illustrations numbers 5 and 6 show the proper placement of Liners to line frogs. Place three Liners against outside rail in direction of throw, two Liners against frog and two Liners against inside rail. The work of lining can be done with one-third the number of men required when using lining bars. This work usually takes a greater period of time with 15 to 21 men using lining bars than is taken by 7 men when using Idol Track Liners.

Illustration No. 5

Illustration No. 6

Illustration No. 7

Illustration No. 8

Illustrations numbers 7 and 8 show the lining of ordinary track. Set two Liners against outside rail in direction to be lined, and one against inside rail.

Illustration number 7 shows three men doing the same work with Idol Track Liners as was formerly done by seven to nine men with lining bars. The seven men using lining bars shown in illustration number 8 could not line the track; the three men with Liners moved the same track easily, without digging out the ballast at the end of the ties. When section crews are reduced to three men, all ordinary track can be lined without waiting for the organization of full forces, and without the doubling of section crews.

Thomas D. Crowley & Co., Gen'l Sales Agents
122 S. Michigan Ave., Chicago, Ill.

Any of These Lubrication Troubles at your Pumping Stations

?

Is it necessary to keep lubricator wide open to get sufficient lubrication—to keep engine from sticking?

Is maximum speed attained, less than engine's r. p. m. rating?

Heavy deposits of dry, hard carbon forming, causing piston rings to stick?

Necessary to use a crow bar to turn engine over in starting?

They disappear when TEXACO LUBRICATION is used

A test of Texaco was made at a pumping station resulting in the elimination of the troubles listed: Feed of lubricator cut to one-third and on second day of test, cylinders showed perfect lubrication, rings free.

Speed increased on third day of test to better than 400 r. p. m. (engine's rating—400) as against former speed of 370 r. p. m.

On second day of test the old carbon deposits were becoming oil soaked and softening up so they could be easily removed. Interior of crank case examined and crank pin well lubricated.

During test of Texaco, engineer never had to use crow bar to turn engine, but did it very easily by taking hold of fly wheel with his hands.

THE TEXAS COMPANY

Railway Sales Department

Atlanta New York Houston Chicago

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There's a Texaco Lubricant for Every Purpose

INLAND STEEL RAILS

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ROLLED FROM

RE-HEATED BLOOMS

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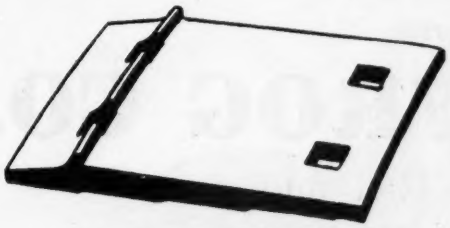
Railroad Crossings, Frogs and Switches

Manganese Track Work a Specialty

Balkwill Cast Manganese Articulated Crossings

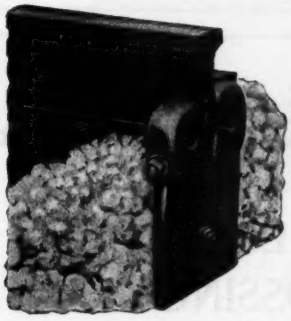
Graham Flange Frogs

(*The Savers of Maintenance*)



The Lundie Tie Plate

Will give rail and wheels longer life.
Will hold gauge and not injure a single fibre of the tie.
Will not rattle.



The Lundie Duplex Rail Anchor

Requires only one anchor per rail.

Will hold in both directions.

The Lundie Engineering Corporation
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166 West Jackson Boulevard, Chicago

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A TYPE FOR EVERY SERVICE

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Diamond Fibre serves faithfully because it is a tough, strong, almost indestructible insulation made by practical men to meet practical railroad conditions. "Old Timers" depend upon it because it more than meets standard specifications.

For more exacting work—where extreme waterproof and extremely high electrical qualities are essential—use Condensite Celoron.

Diamond-F

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Track Work of Rail and
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Manufacturers of Balkwill Articulated Cast Manganese Crossings

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FOR LONG SERVICE

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DIXON'S
Silica-Graphite
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Dixon's Paint is made in FIRST QUALITY only and we have many records of long service in various industrial lines.

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JOSEPH DIXON CRUCIBLE COMPANY

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SWITCHES FROGS
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SPECIAL TRACKWORK
of all Constructions

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MANGANESE STEEL
TRACKWORK

WM. WHARTON JR. & CO., Inc.
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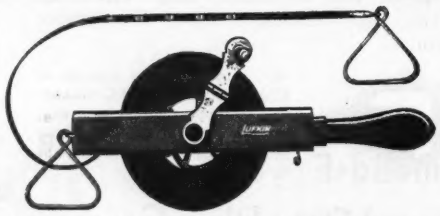

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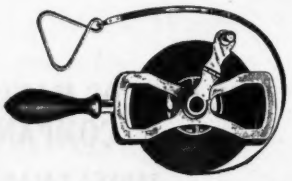

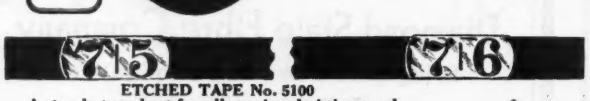

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A sturdy tape best for all precise chaining work.
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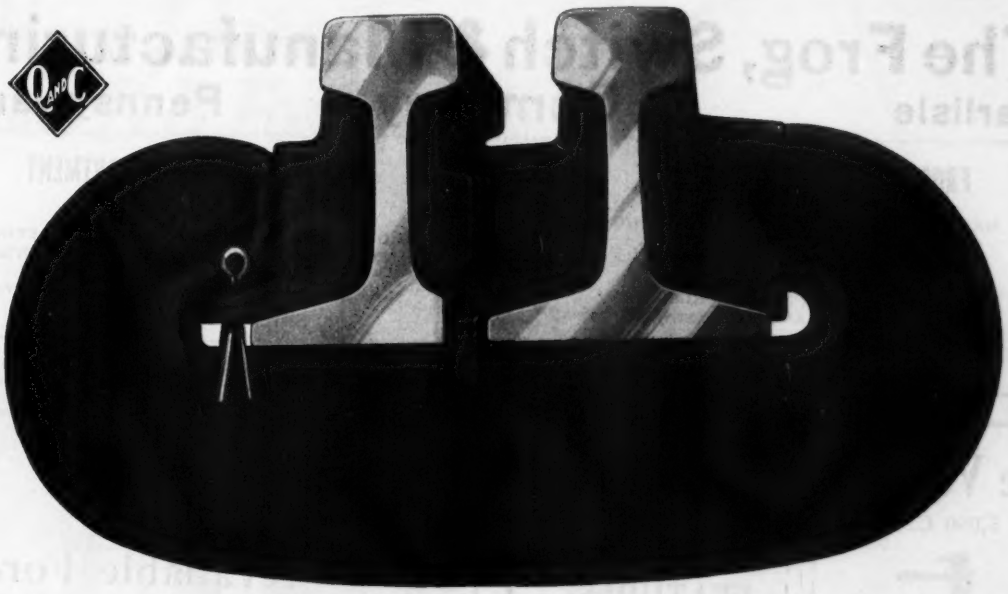

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STATION PLATFORMS

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The station agent at Telford, Pa., stops and starts this Sullivan Tank Pumping installation, 3600 feet distant.

The well, compressor and relift Booster are at the station shown above, 536 feet from the tank.

Capacity of plant, 100 gal. per min. For details, ask for Mine and Quarry No. 1940.

Bulletin 1971-D.

Sullivan Machinery Company
411 Peoples Gas Bldg., Chicago

The Frog, Switch & Manufacturing Company

Carlisle Pennsylvania

Established 1881

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MANUFACTURERS OF
MANGANESE INSERT FROGS, CROSSINGS AND SPLIT SWITCHES
SOLID MANGANESE FROGS AND CROSSINGS
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SWITCH STANDS AND ACCESSORIES

MANGANESE STEEL DEPARTMENT
MANUFACTURERS OF
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HIGH GRADE MANGANESE STEEL CASTINGS
FOR FROGS, SWITCHES AND CROSSINGS
JAW AND GYRATORY CRUSHERS
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The V. G. Portable Flood Light

5,000 C. P. — 10 Hours — 25 Cents

The V. G. Flood Light

FEATURES:

Carbide and water in entirely separate compartments.

Absolute safety.

No waste of carbide.

Will operate extension lights and cutting torches.

Not affected by weather.

Re-charging—easy and clean work.

A necessary equipment for all railroad divisions.

The Blake Mfg. Co.
Mansfield, Pa.

A Larger Output *with* Available Forces

1923 will see a shortage of labor.

The railways have large programs of construction and maintenance work.

This work must be carried on.

How?

THERE IS ONLY ONE ANSWER

Use mechanical equipment to accomplish more work with the same number of men;

And—Devices that will release forces for other work.

Railway Engineering and Maintenance

will furnish suggestions **how** to use mechanical equipment to the best advantage;

And—Enable the manufacturer, through the use of its advertising pages, to show the railway officer where such devices and equipment can be obtained.

Ask

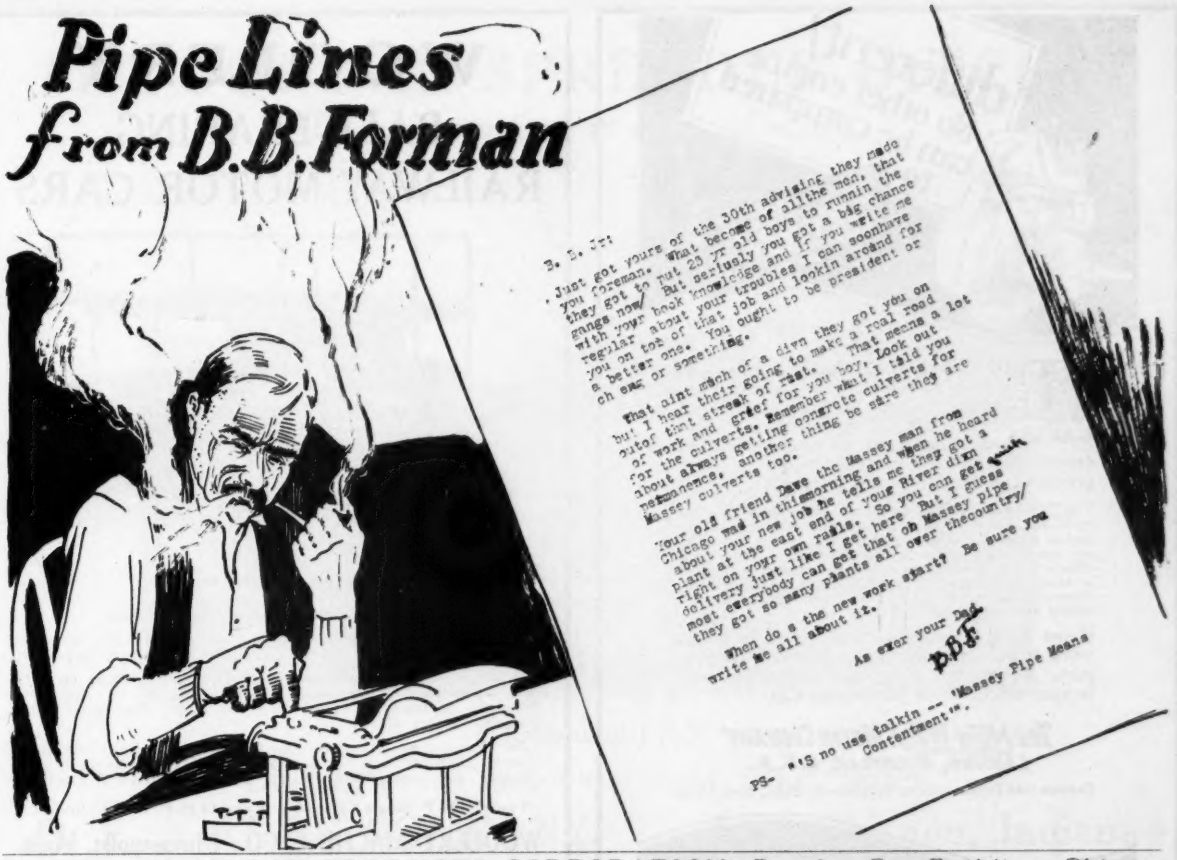
Railway Engineering and Maintenance

Specialists in the Design and Manufacture of

Standard—Insulated—Compromise Rail Joints

The Rail Joint Company, 61 Broadway, New York City

Pipe Lines from B.B.Forman


B. B. Inc:
Just got yours of the 30th advising they made you foreman. What become of all the men that they got to run 23 yr old boys to runnin the gangs now? But seriously you got a big chance with your book knowledge and if you write me regular about your troubles I can soonhave you on top of that job and lookin around for a better one. You ought to be president or ch eap or something.
That aint much of a ditch they got you on but I hear their going to make a real road outer that streak of rust. That means a lot of work and grief for you boy. Look out for the culverts. Remember what I told you about always getting concrete culverts for permanence, another thing be sure they are Massey culverts too.
Your old friend Dave the Massey man from Chicago was in this morning and when he heard about your new job he tells me they got a plant at the east end of your River ditch right on your own rails. So you can get delivery just like I get here. But I guess most everybody can get that ob Massey pipe they got so many plants all over thecountry/
When do s the new work start? Be sure you write me all about it.
As ever your Pal
P.B.F.
PS- e's no use talkin -- 'Massey Pipe Means Contentment'.

MASSEY CONCRETE PRODUCTS CORPORATION, Peoples Gas Building, Chicago

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"SAFETY FIRST" RAILWAY WATER SERVICE BOX

FOR

Coach Yard and Terminal

Positively Self-Closing
Either Full On or Completely Off

No Leakage • No Waste
No Repairs • No Freezing

Nothing to Stumble Over

ALSO

"GENUINE" MURDOCK
SELF-CLOSING HYDRANTS

DRINKING FOUNTAINS
Fool-proof, for Shops, Stations, Offices

Write for Full Information

Pat. Applied For

Type "B" with Westinghouse Coupler

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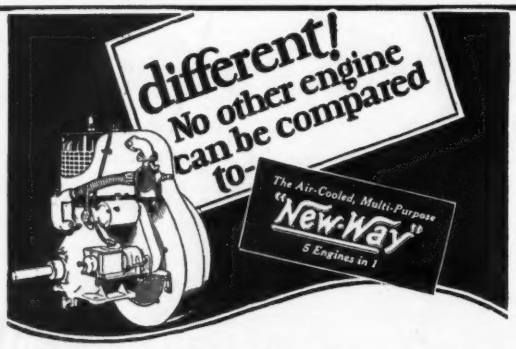
"THE ORIGINAL HYDRANT HOUSE"
CINCINNATI, OHIO.

Makers of Anti-Freezing Water Devices since 1853

BLAW-KNOX
BLAW-KNOX PRODUCTS
—if you operate a Blaw-Knox *Dreadnaught* Bucket
Because the Dreadnaught is built for power—it's built for speed—rugged and husky and will rehandle and dig hard packed material with a minimum of expense for upkeep and repairs.
Hundreds of clamshell users are standardizing on Blaw-Knox Buckets.
MORE POWER TO YOU—if you fit your crane with a DREADNAUGHT
BLAW-KNOX COMPANY
639 Farmer's Bank Bldg., Pittsburgh, Pa.
New York Baltimore Birmingham Chicago Detroit London, England

Blaw-Knox Dreadnaught Bucket digging on a sewer job.

BLAW-KNOX BUCKETS



THE "NEW-WAY" could not be sold within anywhere near its price, nor made of as high quality materials and workmanship if the immense factory and skilled corps of workers did not devote their entire time, energy and ability to producing but one type and size engine.

The "New-Way" is the original and only heavy duty four cycle air cooled engine. It eliminates water nuisance and its attendant troubles. It delivers its full power in any temperature without overheating. It uses either gasoline or kerosene and delivers its power direct or through an electric generator. It runs hand cars, tie tampers, air compressors, electric drills and all other railroad work within its power range.

If *you* have a power problem, let us help you work it out. It incurs no obligation on your part. A letter will bring our traveling engineer to your office. *Write for Circular C23.*

THE NEW-WAY MOTOR COMPANY
LANSING, MICHIGAN, U.S.A.

Eastern and Export Office, Woolworth Bldg., New York

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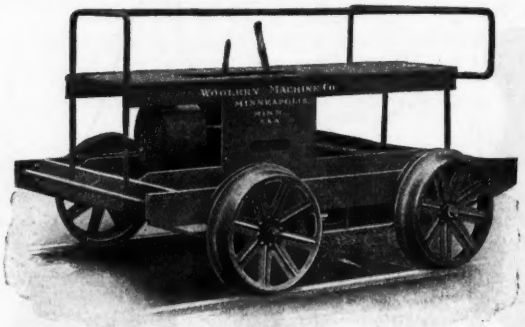
BALL-BEARING RAILWAY MOTOR CARS



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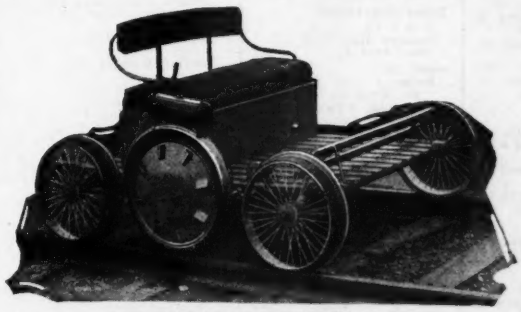

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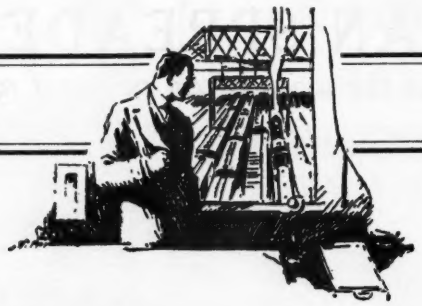

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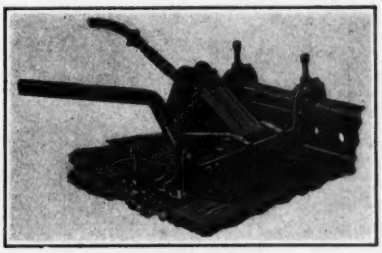
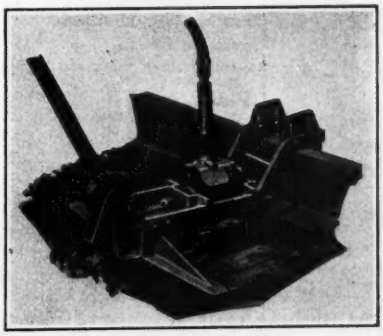


No. 9 "Little David" Rail Drill. Puts a ⅞" hole through web in 25 sec.



"Little David" Bonding Drill, No. 5. Averages 70-$\frac{7}{16}$" holes per hr.

No. 19 "Little David" Rail Bolter. Bolts a 6 hole joint in 1 min.

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Use air operated labor-saving machines

Ingersoll-Rand Pneumatic tie tampers enable small gangs to equal the work output of large hand gangs and to make a smoother, safer and more permanent roadbed. Four men with pneumatic tampers will do as much work as 12 to 16 men hand tamping.

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A pneumatic tamping outfit enables pronounced savings to be made on a wide variety of operations. Ask us for further details on the many uses.

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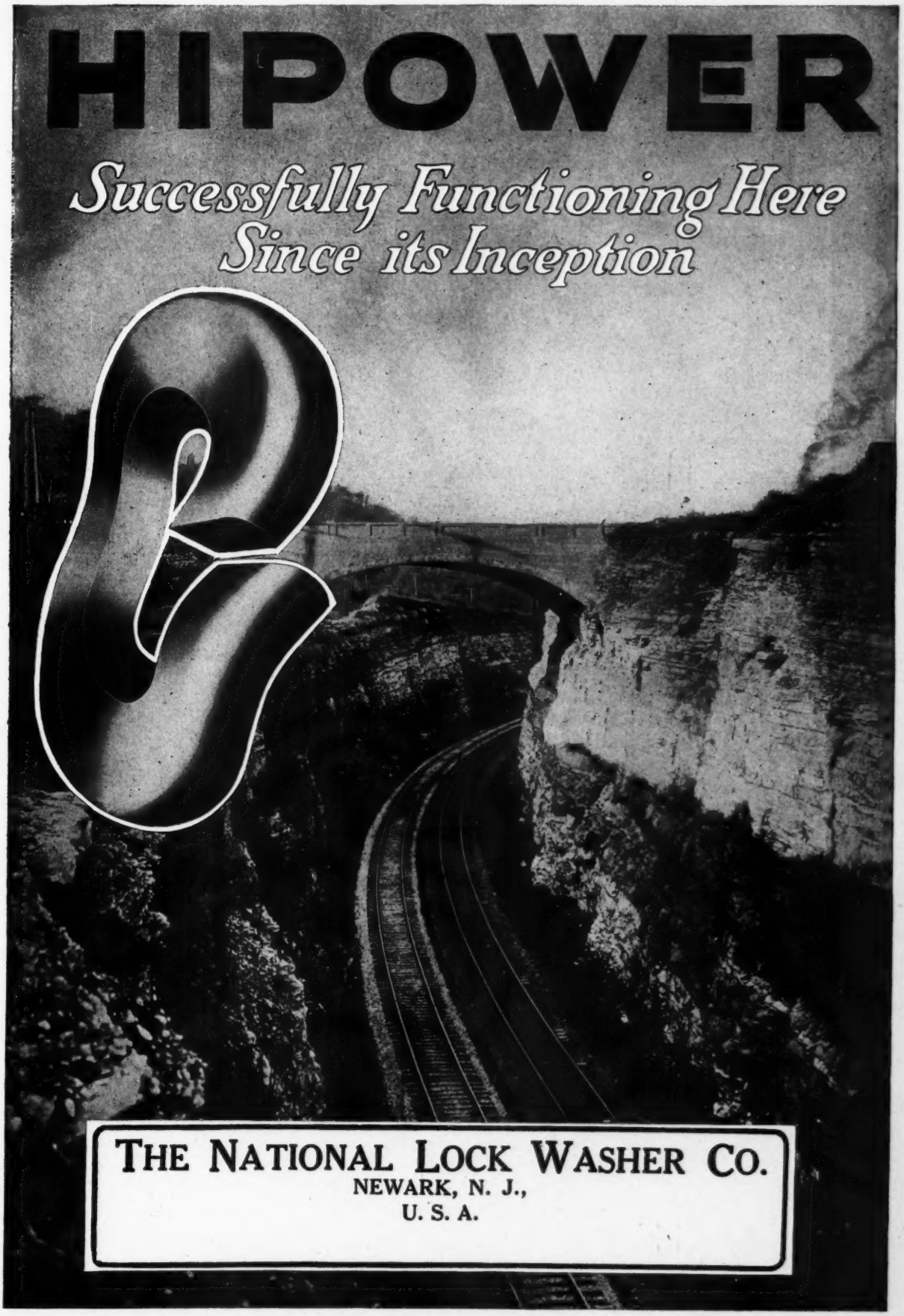
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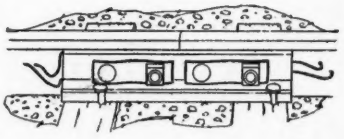
3 Use any kind of nutlock, and keep your gangs tightening most of the time.

4 ***Use Verona Rail Joint Springs.*** Tightening is never necessary. They make joints tight, and despite stretch or wear, they ***keep*** them tight.



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